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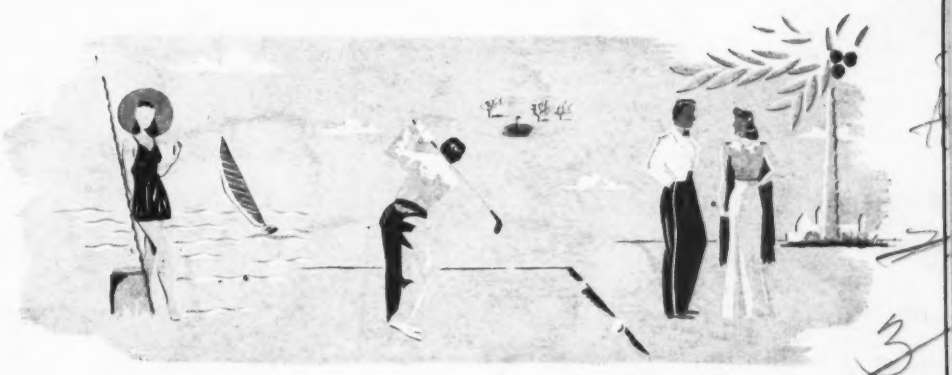

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VOLUME 29 SEPTEMBER 16, 1940 NUMBER 19

The Preparation and Properties of

Alkali Chitin*

C. J. B. THOR and W. F. HENDERSON

INTRODUCTION

In recent years, it has been demonstrated, rather definitely, that the chemical structure of chitin is very similar to that of cellulose[1, 2, 3]. Aside from the question of chain length, chitin can be considered as cellulose in which the hydroxyl group attached to the number two carbon atom of each glucose residue is replaced by a mono-acetyl amino group. In spite of this similarity in structure, however, it is reported that chitin does not swell in dilute alkalies, does not mercerize, is insoluble in ammoniacal copper oxide, in aqueous zinc chloride and in aqueous calcium thiocyanate, and that it does not disperse by the viscose procedure[3, 4]. No preparations of chitin analogous to alkali cellulose or cellulose xanthate have been previously described in the literature. One paper[5] describes a mono sodium derivative of chitin prepared by dissolving the latter in liquid ammonia containing sodium. The process was slow and required the exclusion of moisture from the air because the compound rapidly reverted to chitin in the presence of moisture. Another paper[6] states that chitin seems to form a series of addition compounds with sodium hydroxide when treated with a hot, saturated solution of the alkali. However, the isolation of definite compounds was reported as difficult due to the hydrolysis that occurs.

Although chitin does not xanthate under the conditions generally used to prepare cellulose xanthate, it seemed to us that the reaction might be possible under conditions which would minimize hydrolysis of the essential intermediate compound, alkali chitin. Such hydrolysis should be decreased by increasing concentrations of steep caustic and by decreasing temperature. Very early in the course of preliminary experiments along these lines[7] it was found that a viscous dispersion of sodium chitin xanthate was formed under the following general conditions:

1. Chitin was steeped in 50 per cent aqueous sodium hydroxide for two hours at 25° C.
2. The steeped chitin was pressed free of excess liquor and shredded.
3. The shredded material was shaken in a closed jar with carbon disulfide at room temperature for four hours.
4. The material in the jar was mixed with sufficient chopped ice to leave a chitin concentration of 5 per cent by weight and stored at 5° C. for 18 hours.

A discussion of the preparation and properties of chitin xanthate will be reserved for a subsequent paper, but the observation that chitin xanthate was formed showed that an alkali chitin had been formed under the steeping conditions mentioned above. In order to gain more information on this point, a series of analyses was conducted to determine the extent of combination of chitin with alkali as influenced by concentration of sodium hydroxide in the steep liquor and by temperature.

EXPERIMENTAL

Materials. The chitin used was a flaky product prepared from shrimp waste by the method of Rigby[8]. The various steeping solutions were prepared by diluting with distilled water, a rayon grade of 50 per cent sodium hydroxide liquor.

Method. A 5 g. sample of chitin weighed to the nearest centigram was steeped in 100 cc. of the sodium hydroxide solution in a covered 250 cc. beaker for two hours at the desired temperature. The mixture was then transferred to a Monel metal cylinder fitted with a screen-covered

*Contribution from the Laboratories of The Visking Corporation, Chicago, Illinois.

[1] Bergmann, Zervas and Silberkweit, Ber., *64B*, 2436 (1931).
[2] Meyer and Pankow, Helv. Chim. Acta, *18*, 589 (1935).
[3] Meyer and Wehrli, Helv. Chim. Acta, *20*, 353 (1937).
[4] Kunike, Kunstseide, *8*, 182 (1926).
[5] Schmid, Waschkau and Ludwig, Monatsh., *49*, 107 (1928).
[6] Clark and Smith, J. Phys. Chem., *40*, 863 (1936).
[7] Thor, U. S. Patents 2,168,374 and 2,168,375 (1939).
[8] Rigby, U. S. Patent 2,040,879 (1936).

outlet at the bottom and provided with a close fitting piston. The alkali chitin was pressed as free of excess steep solution as possible, first by hand, and finally, in an ordinary vise. During this operation, the press caustic was caught in a half-pint fruit jar, which was sealed immediately and put aside for later determination of caustic content. The pressed alkali chitin was transferred to a tared weighing bottle and weighed to the nearest centigram. It was then taken up with 250 cc. of hot water, boiled for fifteen minutes and allowed to cool to room temperature. The alkaline mixture was transferred to a 500 cc. volumetric flask and diluted to volume with water. An addition of 3.5 cc. of water was made to allow for the volume occupied by the chitin flakes since the specific gravity of chitin is reported to be about 1.4. After thorough mixing and standing for two hours, the mixture was filtered through a dry filter paper and 25 cc. aliquots of the filtrate were titrated with quarter normal hydrochloric acid to the end-point of methyl red.

A suitable weighed quantity of the press caustic was diluted to a volume of 500 cc. with distilled water, and 25 cc. aliquots of the solution were likewise titrated to the end-point of methyl red with quarter normal hydrochloric acid.

These weight and titrimetric data supplied the following quantities necessary for the calculation of the amount of sodium hydroxide which had entered into combination with the chitin:

C = g. of chitin steeped.
W = g. of alkali chitin obtained.
G = g. of sodium hydroxide contained in the alkali chitin.
P = per cent by weight of sodium hydroxide in the steep liquor at equilibrium, i.e., in the pressed-out caustic solution.

For purposes of calculation, it is assumed that the portion of the sodium hydroxide contained in the alkali chitin which cannot be accounted for as mechanically held steep liquor has entered into combination with the chitin to form a sodium alcoholate. The number of equivalents of sodium so combined per acetyl hexosamine unit of chitin is designated by the letter X. Then the weight of steep liquor held mechanically by the alkali chitin should be equal to

$$W - C(1 + .108X) \qquad (1)$$

since $.108X$ represents the increase in weight per gram of chitin due to replacement of active hydrogen by sodium, i.e.,

$$\frac{\text{Unit weight of soda chitin} - \text{Unit weight of chitin}}{\text{Unit weight of chitin}} = \frac{225-203}{203} = .108 = \text{weight increase per gram of chitin on}$$

combining with 1 equivalent of sodium.

The weight of steep liquor held mechanically by the alkali chitin should also be equal to the weight of sodium hydroxide contained in the alkali chitin minus the alkali which was chemically bound, divided by the fractional content of sodium hydroxide in the steep liquor or to

$$\frac{100\,(G - .197XC)}{P} \qquad (2)$$

The $.197X$ represents the grams of sodium hydroxide liberated by hydrolysis of the sodium bound chemically by each gram of chitin, i.e., $\frac{40}{203} = .197 =$ grams of sodium hydroxide from each gram of chitin when the latter is combined with 1 equivalent of sodium per acetyl hexosamine unit. When expressions (1) and (2) are equated they can be reduced to the following form:

$$X = \frac{100G - P(W - C)}{C(19.7 - .108P)}$$

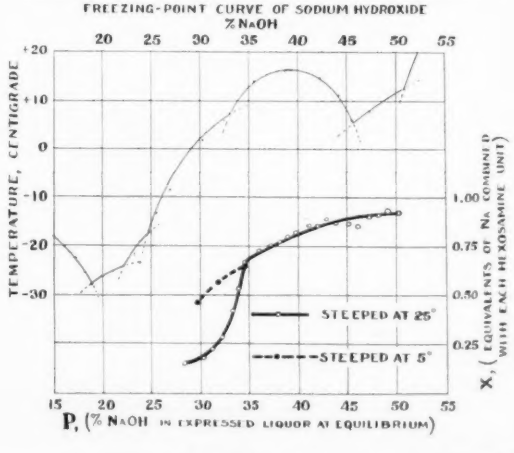
Results. Table I gives a series of data and calculated results obtained by use of the method which has just been described. The values of X are plotted against equilibrium concentration of sodium hydroxide, P, in Fig. 1. Included

TABLE I

Effects of Steep Caustic Concentration and of Steep Temperature on the Combination of Sodium Hydroxide with Chitin
C = 5.00 g.

Steeping Temperature ° C.	*P*	*W*	*G*	*X*
25	28.13	9.67	1.435	.15
25	30.13	10.32	1.740	.17
5	29.91	15.92	3.660	.47
25	31.23	10.33	1.855	.23
25	32.11	11.41	2.290	.28
5	31.86	15.26	3.725	.56
25	33.05	12.10	2.675	.41
25	34.05	13.10	3.180	.53
25	34.86	14.42	3.820	.67
5	34.87	14.34	3.780	.66
25	35.92	14.52	3.980	.71
25	36.92	13.99	3.910	.75
25	37.82	13.82	3.940	.77
25	38.86	13.62	3.960	.79
25	39.80	13.99	4.200	.81
25	40.97	14.02	4.350	.85
25	41.88	14.25	4.510	.84
25	42.84	14.51	4.740	.88
25	43.87	14.55	4.830	.86
25	45.19	14.57	4.965	.86
25	45.99	14.44	4.965	.85
25	47.10	14.12	4.960	.90
25	48.02	14.61	5.275	.91
25	48.93	14.23	5.180	.93
25	50.05	14.61	5.455	.91

Fig. 1—Effect of Steep Caustic Concentration on the Combination of Sodium Hydroxide with Chitin.



also in Fig. 1 is the freezing point curve for aqueous sodium hydroxide taken from data in the literature[9, 10]. It is apparent that the combination of chitin with sodium hydroxide increased rapidly between steep caustic concentrations of 30 and 35 per cent and continued more slowly from 35 to 50 per cent. A decrease in steeping temperature from 25° C. to 5° C. brought about a marked increase in combined caustic in the region of 30 to 35 per cent sodium hydroxide. There is no indication that chitin can combine with sodium hydroxide at concentrations commonly used to prepare alkali cellulose for viscose manufacture. It is interesting to note that the region where appreciable combination of chitin with sodium hydroxide occurs is one where practically all of the water contained in the steep caustic would be required to form the hydrate which would crystallize from such a solution on cooling. While it is obvious that alkali chitin may be prepared with a wide range of combined caustic by varying the concentration of the steep solution or the temperature, it has been found that the most generally useful type is that which contains 0.75 or more equivalents of combined sodium per acetyl hexosamine unit. The following procedure results in a product of this type which is quite satisfactory:

Steep 150 g. of chitin flakes prepared from "shrimp bran" in 3 l. of 43 per cent sodium hydroxide for two hours at 25° C. Penetration of the caustic into the chitin may be facilitated by conducting the steep in a 5 l. round bottom flask under vacuum. Separate the resulting alkali chitin from the excess of steep liquor in any manner which will give a cake of alkali chitin weighing approximately three times as much as the original chitin. This may be done by means of a basket type centrifuge or by filtration on a suitable screen followed by adequate pressing. The resulting cake should then be broken up or shredded to a state of subdivision at least equal to that of the original chitin.

PROPERTIES OF ALKALI CHITIN

When alkali chitin, prepared as described above, is extracted with water, it regains the appearance of the original chitin. That the chitin has not been deacetylated to any appreciable degree, by the treatment with caustic, is indicated by the following facts:

1. It remains insoluble in dilute acetic acid.
2. The nitrogen content remains unchanged.
3. It does not give a violet color when treated with iodine-potassium iodide in dilute sulfuric acid. Chitosan and other deacetylated chitins give a deep violet color under similar conditions.

If the alkali chitin is kept at room temperature for more than a few hours after it is prepared, then deacetylation does become detectable. This can be minimized by storing at temperatures of 0° C. and lower. As far as time of steeping is concerned, it was found that chitin steeped in 38 to 48 per cent sodium hydroxide for eighteen hours at 25° C. was not deacetylated sufficiently to become swellable in dilute acetic acid.

[9] Pickering, J. Chem. Soc., 63:890 (1893).
[10] Landolt-Börnstein, Physikalish Chemische Tabellen (1912), 487.

Shredded alkali chitin, prepared as above, was found to react with materials such as carbon disulfide, ethylene oxide, mono-chloro acetic acid, dimethyl sulfate, and diethyl sulfate to give products with properties not possessed by the original chitin. However, these reactions were neither smooth nor complete due to the unfavorable physical state of the chitin, i.e., relatively large, dense flakes.

When an alkali chitin of this type is mixed steadily with approximately two to four times its weight of chopped ice in an insulated vessel, it disperses quite rapidly. During the process, the temperature of the mixture drops to several degrees below zero C., which is undoubtedly an important factor in bringing about the dispersion. However, when unsteeped chitin is added to a similar mixture of sodium hydroxide and ice, it is not attacked. A dispersion of alkali chitin prepared in this manner is stable for several days if kept near 0° C. At room temperature, chitin will begin to precipitate after several hours and, if allowed to stand until complete, the chitin obtained will be deacetylated to a considerable degree. Dispersed chitin appears to be much more sensitive to deacetylation in dilute sodium hydroxide than is the original chitin in the same caustic concentration. However, this can be minimized by storing and handling such dispersions at temperatures near 0° C.

The discovery that alkali chitin can be dispersed by mixing it with ice should stimulate further research on chitin. It affords a means of preparing chitin in a finely divided form with a minimum degree of degradation. Thus the chitin can be recovered from the dispersion of alkali chitin, by diluting it with a large volume of water, by salting out with sodium sulfate or by neutralizing the sodium hydroxide with dilute acid. The dispersion of alkali chitin prepared as above is also a very satisfactory medium for the smooth preparation of certain derivatives of chitin. When it is mixed with carbon disulfide at a temperature of about 0 to 15° C. it gives a dispersion of chitin xanthate similar in many ways to viscose prepared from cellulose. It also reacts with ethylene oxide or ethylene chlorohydrine to give a glycol chitin which is readily dispersible in dilute sodium hydroxide at room temperature. With dimethyl sulfate it yields a methylated chitin which is soluble in cold water but insoluble in hot water as is one type of methyl cellulose. This product should be useful for studies on the degree of polymerization of chitin. It also should be possible to prepare from this material a fully methylated chitin for use in structure studies. Since it is necessary to keep the dispersed alkali chitin at room temperature or preferably below, in order to prevent the chitin from coming out of solution, it is found to react well only with such reagents as are quite active in this temperature range.

SUMMARY

Alkali chitin analogous to alkali cellulose has been prepared. The reaction of chitin with aqueous sodium hydroxide has been studied and a range of concentrations and temperatures within which useful alkali chitins can be prepared has been determined. An alkali chitin containing

approximately 0.75 equivalents of combined sodium, or more, per acetyl hexosamine unit can be dispersed by mixing it with ice. Such dispersions as well as the solid alkali chitin have been found to react with reagents of the type which attack alkali cellulose.

(To be continued)

—♦ ♦—

Crease-Resisting Textiles*

A. D. J. PIESSE**

TEN years ago, the chief defect of cotton, linen and rayon fabrics was that, unlike wool or silk materials, they creased badly in use, and had little tendency to recover from this creasing after use. This defect had been experienced for so long that it seems to have been accepted in the same way that other natural phenomena, such as thunderstorms, are accepted—it is a nuisance but one can't do anything about it.

The earliest reference to the problem in the technical literature was in the first patent granted to Tootal Broadhurst Lee Co., Ltd., for treating textiles so that they would resist and recover from creasing. The publication of the patents in various countries aroused very little interest, again showing how little even the problem was appreciated, quite apart from its solution. It was not until the patentees announced in 1932 that they were ready to market a range of crease-resisting cotton and rayon fabrics that the interest of the public and the textile trade was aroused.

The principle of this process is fairly generally understood. After dyeing or printing, the dry cloth is impregnated with an aqueous solution of a lightly condensed compound of urea and formaldehyde, containing a catalyst and perhaps a softener. This condensation product has a comparatively small molecule, small enough to penetrate inside the textile fiber and at this stage cannot correctly be described as a resin. After the impregnation in a mangle, the cloth is dried, and then heated to a comparatively high temperature, for a minute or two, to cause the complete condensation of the urea and formaldehyde to a synthetic resin. Finally, the fabric is washed to remove any uncombined chemicals, dried, and finished in the usual manner. The fully polymerized urea formaldehyde synthetic resin can be prepared by itself and dissolved in an organic solvent, but if the fabric is impregnated with this solution and dried, an entirely different result is obtained. The fabric is now only *coated* with resin, and is stiff and brittle with no property of recovering from creasing. Such a process has been known for many years, and has certain practical applications.

At least two possible suggestions have been put forward to explain the crease-resisting property. The first is simply that a core of hard elastic resin inside each fiber imparts some of its own properties to it, in the same way as a steel wire would reinforce a paper tube. The second suggestion is that the resin establishes entanglements between adjacent parallel cellulose micelles, in the same way, but on a larger scale, that the crease-resisting property of the wool fiber is supposed to be due to di-sulfide and salt cross linkages between adjacent protein chains. In my opinion, neither theory can explain the matter completely, as the question of cloth construction plays an important part.

The process is being applied commercially to cotton, filament rayon, spun rayon, velvet and linen fabrics. In the case of cotton fabrics, voiles, both singles and two-ply, are of most importance, but other qualities, mostly of a rather open construction, are being treated successfully. In the filament rayon field, tie cloths and viscose rayon crepe are the best illustrations. Medium weight dress linens and linen suitings are being successfully treated, with the help of an additional process after the heating stage. Crush-resistant velvet, as you know, is now almost standard.

However, it is in the spun rayon field that the process has become of greatest importance. The large scale development of the process took place at the time that staple fiber came to the fore in Europe and it is undoubtedly true that the two developments have benefited each other tremendously. This is easily seen by comparing a crease-resisting spun rayon fabric with the same fabric before processing. It has a considerably greater tensile strength when wet (as you know, one of the greatest faults of viscose rayon has been its low wet strength), it has greater resistance to slippage and fraying, it does not shrink and sag, and above all in use it remains always fresh and tidy in appearance. If dyed with direct dyestuffs, the color will be faster to washing. Further if the increased weight due to the resin is not desired, it is possible to reduce the weight of the grey goods by 10 per cent or more, resulting in a saving to be set against the finishing cost.

I believe Czechoslovakia was the first country to use

*Presented at a meeting of the American Association of Textile Technologists, June 5, 1940.

**T. B. Lee & Co., Inc.

staple fiber in large quantities, before the introduction of this process. In a short time, it had disappeared almost completely because of its many defects, and it was only six or seven years ago that the crease-resisting process led it back to public favor.

Mixtures of wool, silk, or acetate rayon with cotton or viscose rayon can be processed with advantage. Crease-resisting fabrics should not be boiled, treated with acid, or washed in the presence of active chlorine. Apart from these restrictions, the finish stands up to normal washing and dry cleaning. It should be made clear that we do not aim at producing an uncrushable fabric, but one which creases less and will recover from creasing. In the early stages of its development, some really uncrushable materials were marketed, but it was soon found that when made into dresses, the seams could not be pressed flat, and it was impossible to make pleats.

In 1932, when the first crease-resisting cotton and rayon fabrics were put on the market, the attention of other research workers was directed towards the same problem, the very existence of which seems to have been ignored previously. As a result, a steady stream of patents has been issued, until now there are about 150 patents in Great Britain alone claiming processes for the production of crease-resistant fabrics. In general, these patents cover the manufacture or use of other resins than those actually cited in the original patent, or the use of different catalysts, and are covered by the basic T. B. L. patents. As far as I am aware, only two or three of these processes are being used commercially, and then under license from T. B. L.

Our patents do not cover the manufacture of resins or urea formaldehyde precondensates, but we do claim to cover the use of resins in the production of crease-resisting fabrics. There are many finishes on the market consisting of fully condensed resins, or of partially condensed resin constituents, used for various purposes. If the latter are used in such a way as to produce a fabric with appreciable crease-resistance, even if the goods are not sold as "Crease-resisting," they are liable to infringe Tootal Broadhurst Lee's U. S. Patent No. 1,734,516. It should be clearly understood that the patent is not limited to the use of synthetic resins, although we find the best result is obtained in this way.

We have no monopoly of the use of such phrases as "crease-resisting," "anti-crease," "wrinkle-resistant." Most woolen fabrics can be described in this way with perfect truth. However, the misuse of such words has resulted in their losing most of their meaning. We have examined many spun rayon fabrics advertised as "crease-resisting" which have in fact very little resistance to creasing, and have not been treated in any way to improve this property. As a result of this, in order to enable the trade and the public to know what they were buying, we decided to permit our licensees to use our trademark "Tebilized" to describe goods which had been treated by our process and which conformed to standards established by us. While purchasers of Tebilized fabrics would be chiefly interested in their crease-resistance, we felt we must also have control over other properties of such materials. If the general wearing properties were unsatisfactory, for instance, the customer might associate Tebilized goods with poor performance, and the trademark might be in danger of becoming a mark of dissatisfaction instead of one indicating advantageous properties.

The most important standard, naturally, is that the fabric should be crease-resisting. For flat goods, we test this by cutting a strip of the fabric exactly 4 c.m. long and 1 c.m. wide, folding it in the center and placing it under a 500 gm. weight for five minutes. It is then removed and allowed to recover for three minutes, after which the distance between the ends of the strip is measured. This simple test, in our experience, tells as much as more complicated methods. The crush-resistance of velvets is measured by the machine shown in this photograph. The principle is that the initial thickness of the fabric is measured, it is then crushed under a known load, for five minutes, measured again, and allowed to recover for three minutes after which the final thickness is again measured. The amount it recovers is then expressed as a percentage of the distance the pile was crushed down. These tests, while arbitrary, do enable a control to be achieved, which we consider to be satisfactory.

As a result of our experience over many years in testing our own materials, we have established standards for resistance to wear. For this test we use another machine developed by our testing staff, in which the sample under test, mounted on a rotating ring, is rubbed by a standard worsted cloth similarly mounted. These machines have been supplied to our licensees to enable them to control their production.

A third standard is for tensile strength, to ensure that the trademark is not associated with sub-standard goods. We have also established standards for wash fastness of the crease-resisting effect.

You can see, therefore, that if goods are "Tebilized," it means that they have met the standards established by us for crease-resistance, resistance to wear, tensile strength and wash-fastness. In other words, if it's "Tebilized" it has tested crease-resistance. We have recently completed our plans for advertising Tebilized fabrics finished by our licensees in this country and look forward confidently to a very great expansion in the use of the process.

Fifth Annual Processing Review Number Appears

October 14, 1940

Water- and Washing-Resistant

Finishes on Textiles

C. H. S. TUPHOLME

MUCH interest is being shown in the claims for a new process developed in Saxony by which a finish is produced on cellulosic textiles which is fast to water and washing. The process consists in bringing about a limited swelling effect, such that transparency is not developed or only to an insignificant extent. The material is treated with acidic, basic or salt-like swelling agents other than sulfuric acid so as to increase the volume of the fibers by not more than 50 per cent. The material is then rinsed (if desired with the interposition of a drying process) and is then dried. The extent of swelling may be calculated from a knowledge of the volume of the fiber before and after treatment, these volumes being found by determining the displacement of a known volume of mercury by the fibers.

As in the known processes for obtaining transparent effects, solutions may be used which *per se* are capable of causing extensive swelling and producing a transparent effect. These swelling agents, however, are in the present case applied to the fiber in quantities amounting only to 10 per cent to 50 per cent of the weight of the article, so that it is necessary thoroughly to distribute this comparatively small amount of swelling agent over the fiber. This can be done in a very simple manner by spraying the swelling solution in the form of vapor or by treating the material in a bath and employing a suitably adjusted squeezing device.

Another method consists in applying the usual swelling agents in concentrations lower than those required for attaining transparent effects. It is not possible, of course, to use any low concentrations desired, but those employed should have only slightly less strength than is required for producing transparent effects, since otherwise the treatment would require considerable time.

When drying is effected after the slight, preferably superficial, swelling and removal of the swelling agent by rinsing, the surface of the fiber appears to be changed since it is not smooth as before but seems to be covered with crater-shaped elevations and depressions. The matt surface thus produced is particularly desirable for goods which previously had an unsightly luster, but the roughening of the surface increases also the apparent volume and, owing to the reduction of the frequently excessive smoothness, insures better workability and greater durability. Swelling further imparts a certain plasticity to the fiber or to its surface, the individual fiber stresses disappearing, and the fibers fit more closely into one another. The fibers, moreover, approach one another and may even partially adhere to one another in a superficial way, so that the textile structure is stiffened and made more durable without any increase in weight, since the finish is, so to speak, formed out of the fiber.

This effect may be still further increased by subjecting the plastic structure to pressure and/or heat. In this way tighter packing is obtained, the air spaces between the fibers and layers of fibers become smaller and the increase in the stiffness of the material after removal of the swelling agent is still greater. When yarns are treated in this manner and then reduced to fiber according to known methods, staples of single fibers will result which appear curly and can be made into wool-like yarns and fabrics. As the matting of the surface has a similar effect as the scaly structure of wool fibers, materials of this class may even be fulled when mixed with animal fiber.

Of the swelling agents available, salts are preferred, though acids and alkalies also produce good results. When acids are used, drying before rinsing should be omitted in view of saccharification. In the case of alkalies a relatively strong formation of oxycellulose is often troublesome, so that lower concentrations should be given preference, which can easily be accomplished due to the wide scope of reaction of alkalies.

The swelled articles may be subjected wholly or partly to the effect of pressure and/or heat, the pressure being applied if desired in such a way as to produce an embossed or pattern or Jacquard effect.

In an example of application of this process: (a) On a three roller padding mangle an artfiicial viscose crepe is passed between the second and third roller, the rollers being so adjusted that the fabric can take up 30 per cent of its weight of 40° Bé. nitric acid. The goods are only slightly moistened in this way and are then permitted to lie for a while, whereupon they are thoroughly rinsed in flowing water and dried. The fabric thus acquires a full water-resisting and wash-resisting feel as well as increased tearing strength and resistance to rubbing. (b) If the same material is passed through the same bath without squeezing a very high stiffening effect is produced which completely changes the nature of the article.

In a second example: (a) A zinc chloride solution of 67° Bé. is applied with a sprayer to cloth of viscose or

(Concluded on page 480)

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

SEPTEMBER 16, 1940

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• CALENDAR • OF COMING EVENTS

The first of the second series of lectures sponsored by the Midwest Section and given by Dr. Malcolm Dole will be given September 20, 1940, at the Chicago Lighting Institute, 20 N. Wacker Drive, Chicago, Ill. Subject: "pH and Detergency." All interested persons are welcome.

Meeting, Southeastern Section, Civic Room, Hotel Ralston, Columbus, Ga., September 21st, 1940. Speaker: W. D. Anderson, president of Bibb Manufacturing Co., Macon, Ga. There will also be a technical paper, the subject of which will be announced later.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

Meeting, Piedmont Section, Carolina Hotel, Pinehurst, N. C., November 1 and 2, 1940.

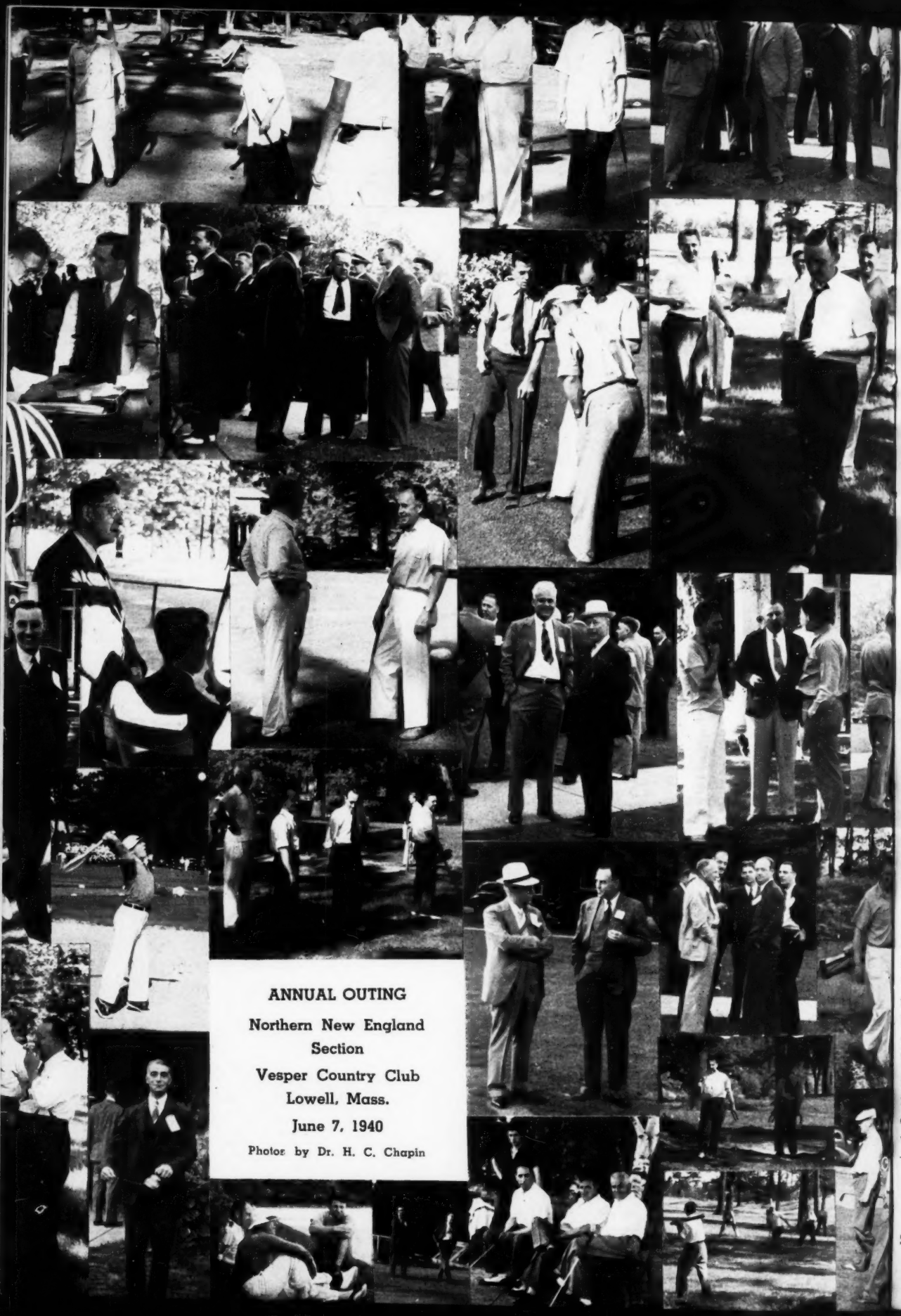
For the Ladies

AT THE ANNUAL MEETING

MISS BERNICE S. BRONNER of Good Housekeeping Institute, Chairman of the Ladies' Committee for the twentieth annual meeting and convention, announces that events of especial interest are being planned for feminine visitors who accompany association members to New York.

A special room at the hotel has been set aside for the ladies. Among the events anticipated are a style show, sightseeing trips, visits to department stores, radio broadcasts, and other places of interest.

We urge all ladies to take advantage of this opportunity to come to New York, as a real effort will be made to see that they enjoy themselves.



ANNUAL OUTING

Northern New England Section

Vesper Country Club

Lowell, Mass.

June 7, 1940

Photos by Dr. H. C. Chapin

Technical Evaluation of

Textile Finishing Treatments

IV. A Comparison of Certain Methods of Measuring Stiffness in Fabrics

LELIA J. WINN* and EDWARD R. SCHWARZ, F.T.I.**

ABSTRACT

Quantitative comparisons of various methods for measuring fabric stiffness are discussed and application of the analysis of variance to the interpretation of test results of this character is given with numerical examples.

THE object of the tests described in Part II[1] of this series is to find a sensitive method to determine stiffness, especially a method that can distinguish between small differences in finish. For a better understanding of the following discussion, definitions of various types of stiffness will be of assistance. Thus:

Handle describes the feel of the material and qualitatively includes such terms as stiff, limp, hard, soft, rough and smooth.

Flexibility is the ease with which a specimen may be bent. In certain cases the weight of the material acts to bend it about an axis.

Rigidity is the measure of resistance offered by the specimen to bending. This is a measure of stiffness.

Drape differs from rigidity in that the weight of the material influences a deformation at some angle to the line of action.

As has been stated[1] the methods employed may measure the deformation or the forces which produce the deformation. They may be influenced by the fabric's thickness, weight, compactness, finish, kind and state of yarn and fibers, and by external conditions such as the relative humidity and temperature of the surrounding air, rate of loading, amount of loading and the time which elapsed between loading and measuring.

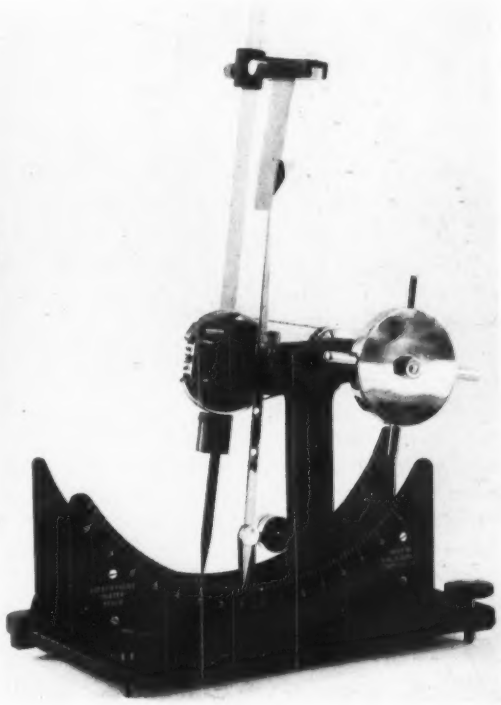
Four different types of stiffness testers were used.

1. The Hanging Heart Loop Test of Peirce[2] bends a 1" x L" specimen to a heart-shaped loop. The length of loop hanging freely under its own weight is compared with the length of a theoretical loop and a correction is made to give the length of cantilever strip (c)† which would bend under its own weight to a standard angle. The product of the weight per unit area and the cube of the bending length is the flexural rigidity of the material (G). It rates *stiffness* as would a person handling the material. The thickness of the material is taken into consideration in another quality, the bending modulus (q), which measures the *compactness* of the material.

2. The Gurley Stiffness Tester supports a strip, ½"-1" or 2" wide and 1", 1½", 2½", 3½" or 4½" long (as desired), in a vertical position and measures the force in milligrams needed to bend the strip through a sufficient angle to cause slippage of the specimen over the vane. The force is produced by the deflection of a weighted pendulum-type vane which slides over the surface of the specimen as the supporting arm is rotated alternately to each side. The thickness of the material is not considered. The influence of the weight of the material is not wholly eliminated because the specimen is bent out of its vertical position. (See Figure 1.)

The reading obtained in the test is multiplied by a

Figure 1



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**Professor of Textile Technology, M.I.T.
†"c" is the bending length.

factor to give the stiffness in milligrams for a standard size sample, 1″ x 3″. The size of the specimen, the number of thicknesses of material used at the same time, and the weight on the vane may change the final result. The angle through which the specimen is bent varies a few degrees. A very soft fabric has been found to be too near the lower limit of the machine to be tested exactly.

A thicker, heavier material shows relatively stiffer in the Gurley Stiffness Tester than by the Hanging Heart Loop. An organdie shows softer, and the "velvet", plain thick cotton, and congo cloth show stiffer[1]. When the samples are approximately the same weight and thickness the two methods give the same results.

3. The Schiefer Flexometer[3] measures the force which is necessary to bend two specimens 1¾″ x 4″ mounted in opposition on plates to an angle β by means of the deflection of a steel spring. Angle β is calculated from the thickness of the sample so as to give comparable results. Since both ends of the specimen are supported, the weight factor is eliminated. (See Figure 2.)

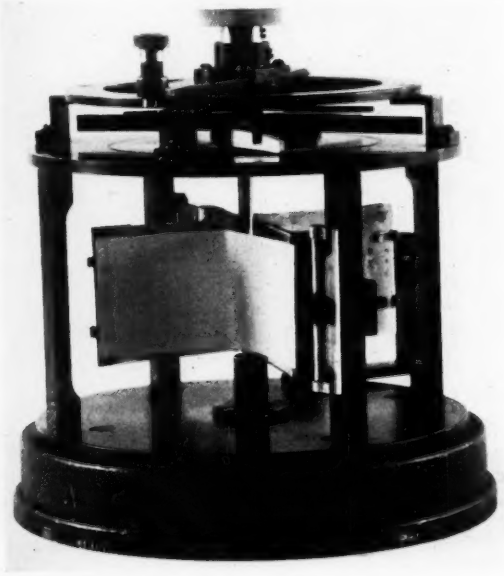


Figure 2

The Schiefer Flexometer shows results similar to those of the Hanging Heart Loop and the Gurley Stiffness Tester. Close agreement is lacking because the compactness of the sample is more important in the Flexometer which bends the specimen to a much smaller angle. The difference is not due to the calculation of β because materials of the same thickness also show this difference in agreement. A hard finish such as that on the Tracing Cloth and the Friction Calendered Tag Cloth* material shows stiffer in the Schiefer Flexometer. The measurement is more variable and harder to control because so much force is necessary to bend two specimens to such a small angle. Reference to Fig. 3 shows the sort of

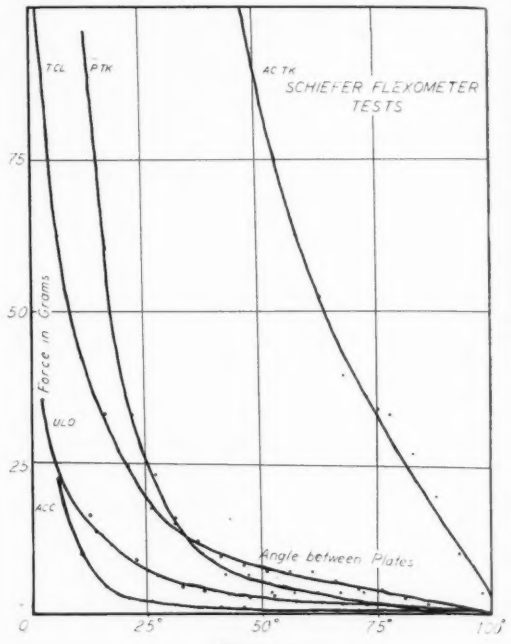
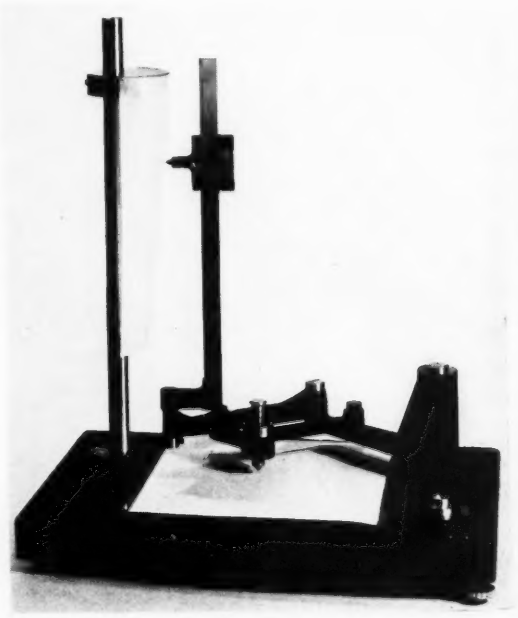


Figure 3

occasional crossing of curves which makes it difficult to select a satisfactory force or angle at which to make comparable determinations.

Figure 4



*A more detailed description of this material will be found in Part V of this series.

4. The Drapeometer (Fig. 4) measures the resistance of the specimen 4.7″ x 10″ to bending by measuring the spread of the sides below the top edge which is bent into a semi-circle. The thickness factor is not taken into account. The weight in this tester acts at a different angle than the direct bending force. The compactness of the material is important because a compact specimen carries the force of the bend further and so a compact material does not straighten out as soon as an open material. Thus the compactness shows an inverse relationship to the stiffness as shown by the Drapeometer. In Fig. 5 the curves rarely cross and any convenient distance along either axis may be used as a point of comparison.

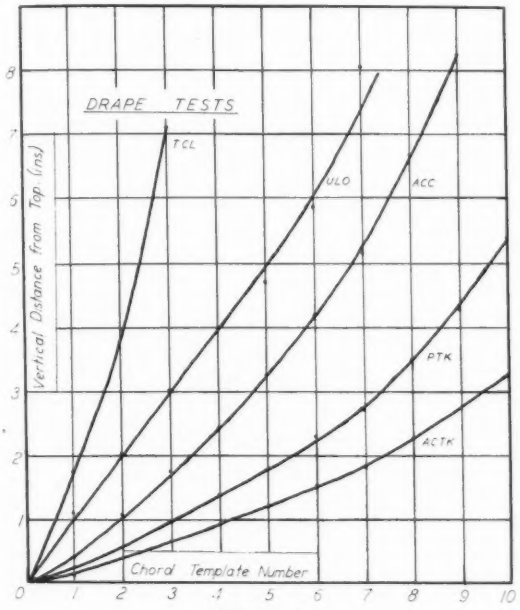


Figure 5

The Drapeometer measures fabrics of the same type and treatment in the same stiffness order as the Hanging Heart Loop. Although the Hanging Heart Loop shows the best range and measurement for all types of materials, the Drapeometer shows up a difference in treatment because of its dependence on the compactness of the material and inherent forces existent therein. For tests where small differences in treatment on the same material are important, the Drapeometer will show these differences.

The experimental model of the new Drapeometer is constructed to measure the specimen's contour, chord width and possible additional data of interest. The drape disc is 3″ in diameter with a flat back so that it is easier to remove the adhesive tape when the test is completed. Its center front point is marked. The edge should be the ½″ width of the tape. The disc may be moved up and down its supporting vertical rod. The transparent tape is attached to the upper edge of the specimen while it lies flat so that the specimen is under no further tension when mounted on the disc. Facing the disc is a pantograph device, to which is attached a vertical arm carrying a pointer. The pointer may be adjusted to any height on the vertical arm on the side of which is a suitably graduated scale. The drape disc is so adjusted that at the zero reading on the scale the pointer will be on the top, *free* edge of the specimen. Thus the vertical distance of the pointer from this edge may be read directly from the scale on the vertical arm. A metal point is set in the pantograph which indicates the horizontal position of the pointer reduced to 2/3 scale. This point is depressed at will to make a dot on a sheet of paper held in place on the platform under a sheet of carbon paper.

The contour of the specimen at any given height is found by bringing up the pointer to the fabric surface at intervals, as 1 cm., and depressing the marker each time. At the end of the test the complete curve is drawn through these points. The zero arc for the test is the contour arc of the top edge of the specimen before it is allowed to flare. This arc will vary slightly in size according to the thickness of the specimen tested.

Reference to Fig. 6 will make evident how the contour

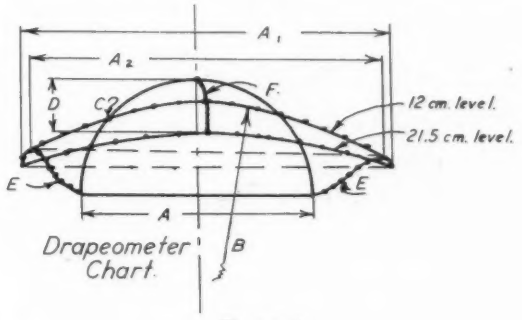


Figure 6

curve at any desired level may be compared to this zero line in several ways, such as the length of chord (A), the radius of the circle from which the arc could have come (B), the intersection (C) or vertical separation of the curves (D). The chord width is found by bringing the pointer to the two side edges of the specimen at a given level. If a given chord width is expressed as a per cent of the zero chord width, the measurements do not have to be multiplied by 3/2. The contour arcs are slightly flatter from the center point to the edges than an arc of a circle. The height of the arc is the distance from its midpoint to the midpoint of the circle of the zero-line arc. The chord end point locus (E) of the specimen may be found by measuring at intervals down the sides. If a line (F) has been drawn down the center of the specimen that may also be measured for contour.

A pliable specimen cannot resist the shape to which it has been bent by the drape disc and hangs in that shape below the disc and flares very little at the bottom. A stiff specimen resists the bending and returns to a nearly flat surface at some point along its length. Samples of inter-

mediate stiffness assume a shape between these two indicating their relative stiffness by the closeness to which they return to a flat surface. The measurement of the chord width has been used to show the amount of flare and with the new Drapeometer the entire contour may also be considered. Preliminary tests indicate that there is a vertical line down each side of the center of the specimen at which the flare starts. The line is near the edge of the specimen when it is pliable and flares very little, and it is nearer the center in a stiff specimen.

As a specimen becomes stiffer, the chord end-point locus describes a longer arc and then curves out and back as the specimen flattens and bows in. The center line should not slant to either side if the material is correctly mounted. It slants directly in as the sides flare to make a wider, shallower arc. Symmetric curves indicate uneven distribution of forces in the specimen which the finishing has produced or has not removed. Horizontal lines from edge to edge at different points will not be parallel to each other and the zero line when the specimen flares unevenly because the two edges will not give similar arcs.

The Drapeometer records make visual comparison of specimens easy and form a permanent graphic record of the test. As many records as desired may be made simultaneously by employing a number of sheets of paper alternated with carbon paper.

It was found that the factors of specimen weight and thickness had varying degrees of influence on the stiffness measurements made by the different test methods. Since the Hanging Heart Loop method of Peirce gives stiffness values with and without weight correction, and since the measurement does not involve external forces, this method was used as the basis of comparison. The grand averages of the fabrics were made into a stiffness ranking for each method. Then the weight in milligrams and thickness in centimeters for each fabric were used in a correction factor and applied to the fabric value so as to change the ranking of a given method to compare with that of the Flexural Rigidity, G, of the Hanging Heart Loop. The value G is equal to the Bending Length, c, corrected for the weight of the sample by multiplying the cubed value of c in centimeters by the weight in milligrams. The Gurley Stiffness Tester and the Schiefer Flexometer methods were corrected to G because they were designed to eliminate the weight factor. There was no provision made to cancel the weight effect in the Drapeometer, for in actual practice the weight is influential, and these values were therefore corrected to c.

The rank correction factors may not be used to change a given value of one method to a given value for another method because the ratio of the corrected value to the value of the test method to which it has been corrected (See Fig. 7) increases as the specimen becomes softer when a value is corrected to the G ranking and decreases when a G value is corrected to another test method ranking.

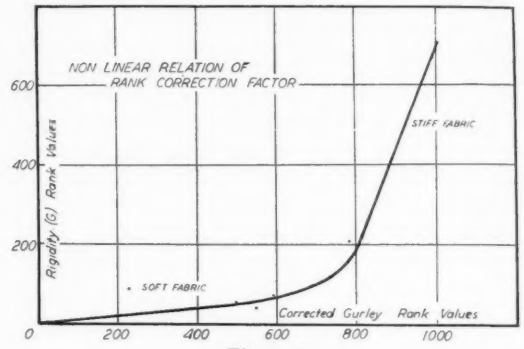


Figure 7

Values in the rankings which are too close to be significantly different are connected by dashes. In each case the rank to which the other has been corrected is placed in the objective order. The Y values of Kendall[4] are given. When n = 10 a value above 50 per cent indicates that the two rankings are significantly alike.

The correction factor to change the ranking order given by the Gurley Stiffness Tester to conformity with the order given by the Flexural Rigidity, G, shows the weight to have more influence than the thickness on the Gurley stiffness readings, although both factors are more influential than in the Hanging Heart Loop method. The rank correction factor for the Gurley Stiffness Tester is the reciprocal of the weight squared times the square root of the thickness $\frac{1}{W^2\sqrt{T}}$

and (Gurley Stiffness Tester)^2 $\times$ (rank correction factor) = G′ where G′ = corrected reading to be entered in a revised rank.

G rank = 1 2 3 4 5 6 7 8 9 10 Y = 68.9%
Gurley rank
(corrected) = 1 2 3 5—4 10 6 8 9 7

or considering the reverse case, we have

Gurley rank = 1 2 3 4 5 6 7—8 9 10 Y = 91.1%
G rank
(corrected) = 1 2 3 5 4 6 8—7 9 10

whereas the original ranking was:

G rank = 1 3 2 4 6 5 7 9 8 10 Y = 37.8%
Gurley rank = 1 2 4 9 10 3 5 7 8 6

The rank position for the Treated Congo cloth will illustrate how the values were calculated. The Gurley Stiffness Tester value for this fabric is 319. The rank correction factor of the Treated Congo cloth is $\frac{1}{126}$. Therefore to change the Gurley ranking to the G ranking we divide 319^2 by 126 to get G′ = 808. The G value for the Treated Congo is 111. Therefore to change the G ranking to the Gurley Stiffness Tester ranking we multiply 111 by 126 to get 13,986.

The following table illustrates how the first ranking was made.

	AcTK	*TC*$_1$	*PTK*	*ULO*	*AcC*	*LO*	*PC*	*PTh*	*AcTh*	*V*
G	11,094	715	675	215	111	92	79	60	52	44
Gurley rank (corrected).....	12,756	7,183	990	781	808	227	588	495	371	546
	which the correction factor is $W^2\sqrt{T}$									
	501.8	10.3	489.3	3.2	126.0	3.7	105.5	16.0	17.2	62.0

The correction factor to change the ranking order given by the Schiefer Flexometer to the order given by the Flexural Rigidity, *G*, shows the thickness to have more influence on the Flexometer readings than the weight when the ranking is compared to *G* (which takes the weight into account). If compared to the uncorrected Bending Length (c), the weight would have more influence. The rank correction factor for the Schiefer Flexometer is

$T/\sqrt{W}$ where T is the thickness and W is the weight and (Schiefer Flexometer value)^2 × (rank correction factor) = G′.

G rank = 1 2 3 4 5 6 7 8 9 10 Y = 91.1%
Flexometer rank (corrected) = 1 2 3 4—5 7 8 6 9 10

and the reverse case

Flexometer rank = 1 2 3 4—5—6 7 8 9 10 Y = 91.1%
G rank (corrected) = 1 2 3 6 4 5 7 8 9 10

whereas the uncorrected rankings are

G rank = 1 3 2 4 6 5 7 9 8 10 Y = 82.2%
Flexometer rank = 1 3 2 5 7 6 8 9 4 10

and, while still significantly similar, have a lower value of Y.

The rank position of the Treated Congo will illustrate how the values were calculated. The Schiefer Flexometer value for this fabric is 38. The weight correction factor of the Treated Congo is .0073. Therefore to change the Schiefer Flexometer ranking to the *G* ranking we multiply 38 squared by .0073 to get G′ = 10.5. The *G* value for the Treated Congo is 111. Therefore to change the *G* ranking to the Schiefer Flexometer ranking we divide 111 by .0073 = 15,263.

The correction factor to change the ranking order given by the Drapeometer to the order given by the Bending Length, *c*, shows the thickness to have more influence than the weight on the Drapeometer readings. The rank correction factor for the Drapeometer is $\frac{\sqrt{W}}{T\sqrt{T}}$ where T is the thickness and W is the weight. To correct to *G* this factor would be multiplied by the weight since $G = Wc^3$ and (Drapeometer value)^{10} × (rank correction factor) = c′

c rank = 1 2 3 4 5 6 7 8 9 10 Y = 82.2%
Drapeometer rank (corrected) — 3 4 1 2 5 6 7 8 9 10

and the reverse case

Drapeometer rank = 1 2 3—4 5 6—7 8 9 10 Y = 91.1%
c rank (corrected) = 1 2 4—5 3 6—7 8 9 10

whereas the original ranking was

c rank = 1 5 2 3 4 8 9 7 6 10 Y = 1.6%
Drapeometer rank = 1 2 10 3 4 6 7 8 9 5

The rank position of the Treated Congo will illustrate how the values were calculated. The Drapeometer value for this fabric is 3.86. The weight correction factor of the Treated Congo is 716.71. Therefore to change the Drapeometer ranking to the *c* ranking we multiply 3.86 to the tenth power by 716.7 to get c′ = 526,280,870. The c value for the Treated Congo is 1.63. Therefore to change the *c* ranking to the Drapeometer ranking we divide 1.63 by 716.71 = .0023.

The rankings of the different methods may be corrected to each other by using the factor which corrected them to the G ranking. Thus

$$\frac{\text{(Gurley value)}^2}{\text{(rank correction factor)}} = 1\ 2\ 3\ 5—4\ 10\ 6\ 8\ 9\ 7 \quad Y = 68.9$$

$$\frac{\text{(Flexometer value)}^2}{\text{(rank correction factor)}} = 1\ 2\ 3\ 4—5\ 7\ 8\ 6\ 9\ 10$$

Thus we see that an increase in thickness causes Gurley Stiffness Tester readings and Drapeometer readings to become smaller, while it causes the Schiefer readings to become larger. When the Flexural Rigidity, *G*, is corrected for thickness it also becomes smaller when the specimen is thicker. An increase in weight causes Gurley Stiffness Tester readings and Schiefer Flexometer readings to become smaller, while Drapeometer readings and *G* readings become larger. The increase affects the methods to different degrees. For instance, a weight change shows most on the Gurley Stiffness Tester readings, least on Schiefer Flexometer readings. A thickness change shows most on Drapeometer readings and least on the Gurley Stiffness Tester readings.

Readings made in a given laboratory or in different laboratories can be compared even though carried out by different methods if the Kendall ranking scheme is used and suitable rank correction made. The foregoing correction factors are offered to show the possibilities of the method and they should be taken as illustrative rather than absolute in the absence of further investigation.

APPPLICATION OF THE ANALYSIS OF VARIANCE

When tests are made there may be two kinds of variations present. If the variation is entirely random it is

homogeneous and is caused by many indistinguishable small factors. However, there may also be definite independent variations due to existing different conditions which may be separated out from the random variations. The analysis of variance[5, 6, 7] differentiates between these variations and gives results which may be tested for significance. Since an experiment is planned to give randomization, results obtained under one set of conditions may be compared with results obtained under another set of conditions by testing the differences in variation. The variance is a measure of variation. It is equal to the sum of the squares of the deviations from the mean divided by the degrees of freedom. Variance is an additive quantity in which each independent cause contributes its variance. The total variance is the sum of the variances due to these causes.

When there is one factor of variation, as for instance with a cotton cloth given two different finishes*, we have

Stiffness Readings

	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*
Calendered Finish A.	22.35	22.44	22.30	21.95	22.38
Calendered over Bar Finish B	24.68	23.90	23.68	24.59	24.69

1. The total sums of the squares** is equal to the squared sum of the deviation of each x from the general mean ($\bar{x}$).

$$\bar{x} = \frac{\Sigma x}{n} = \frac{232.96}{10} = 23.30$$

$$\sum_{1}^{10} (x - \bar{x})^2 = 11.3160$$

	Deviation from 23.30	*Squared*
22.35	.95	.9025
22.44	.86	.7396
22.30	1.00	1.0000
21.95	1.35	1.8225
22.38	.92	.8464
24.68	1.38	1.9044
23.90	.60	.3600
23.68	.38	.1444
24.59	1.29	1.6641
24.69	1.39	1.9321
		$\Sigma = 11.3160$

2. The sum of the squares within each finish is equal to the squared sum of the deviation of each x in that finish from the mean of the finish.

	Deviation from 22.28	*Squared*
22.35	.07	.0049
22.44	.16	.0256
22.30	.02	.0004
21.95	.33	.1089
22.38	.10	.0100
		$\Sigma = .1498$

	Deviation from 24.31	*Squared*
24.68	.37	.1369
23.90	.41	.1681
23.68	.63	.3969
24.59	.28	.0784
24.69	.38	.1444
		$\Sigma = .9247$

$$\bar{x}_a = \frac{\Sigma x_a}{a} = \frac{111.42}{5} = 22.28$$

$$x = \frac{\Sigma x_b}{b} = \frac{121.54}{5} = 24.31$$

and $\sum_{1}^{5} (x_a - \bar{x}_a)^2 = .1498$ $\quad \sum_{1}^{5} (x_b - \bar{x}_b)^2 = .93$

$$\sum_{1}^{5} (x_a - \bar{x}_a)^2 + 5 \sum_{1}^{5} (x_b - \bar{x}_b)^2 = \Sigma\Sigma (x - \bar{x}_1)^2 =$$

where $\bar{x}_1$ = mean of one group.

3. The sum of the squares between the finishes is equal to 5 times the squared sum of the deviation of the mean of *a* from the general mean plus the deviation of the mean *b* from the general mean, since the value of $\bar{x}_a$ and $\bar{x}_b$ represent 5 single readings.

	Deviation from 23.30	*Squared*
22.28	1.02	1.0404
24.31	1.01	1.0201
		$\Sigma = 2.0605 \times 5 = 10.3025$

$$5[(\bar{x}_a - \bar{x})^2 + (\bar{x}_b - \bar{x})^2] = 5 \sum_{2} (x_1 - x)^2 = 10.30$$

The sum of the squares within the finishes plus the sum of the squares between the finishes equals the total sum of the squares. This is true as long as sufficient decimal places are used in $\bar{x}$. For example here 1.08 + 10.30 = 11.38 because $\bar{x}$ was carried out to only 2 places while the true total is 11.32.

The data may be set up for convenience, thus

	Sums of Squares	*Degrees of Freedom*	*Variance (Mean Square)*
Whitin	1.08	$\div$ 8 = f_1	0.14 = S_1^2
Between	10.30	$\div$ 1 = f_2	10.30 = S_2^2
Total	11.32	9	

The variance between groups is larger than that within a group. The variance within is compared with the variance between to determine the significance of the latter. If the two variances are exactly the same, as would be the case if the only sources of variance were those within, then the variance within equals the variation between and

$$F = \frac{S_2}{S_1} = 1.$$

*See Part V for further applications.

**Here the sum of the squares is to be understood as the sum of the squares of the deviations from the mean.

The quantity "F" is subject to random variations and, if the experiment is repeated a number of times, F will be distributed in a regular manner. Thus the distribution of F from tabulated results may be used to determine the probabilities of its values. R. A. Fisher[6] worked out this distribution so that a significance test in which

$z = \frac{1}{2}\ln F$, or $\frac{1}{2}\ln\frac{S_2}{S_1}$ (where S_2 is taken as the larger value).

The distribution of z depends on the degrees of freedom from which the variances are estimated. If the calculated value of z is above that given in the table for the given degrees of freedom, then the variation between groups is significantly larger than the variation within the groups since it occurs more often than random effects could produce.

There is often more than one independent source of variation. When there are two, a different form of table and a particular arrangement of data or of sampling is employed. The method is discussed by Fisher[6] in detail.

The analysis of variance was used on a series of tests to find whether given treatments and finishes made a significant difference in the stiffness of a cotton material. The standard deviation thus found was also used in a "t"-test[5, 7] to determine the smallest significant difference between the average stiffness readings of samples tested. This difference is important in making a stiffness ranking and is also a measure of the sensitivity of the test method.

A different treatment was given to each of three lengths of the cotton material. Each length was then subdivided into four pieces which were finished by different methods. Thus there were 12 pieces in all

Tag	*Heavy*	*Medium*
1. C.	5 C.	9. C.
2. F.C.	6. F.C.	10. F.C.
3. S.C.	7. S.C.	11. S.C.
4. C.B.	8. C.B.	12. C.B.

Five sections from each piece were chosen so that no two had the same warp or filling threads so as to give as wide a sampling range as possible. A specimen for each method of testing was taken from each section. Only the warp direction was tested. Thus each method gave 5 stiffness determinations.*

A separate analysis of variance was made for each test method. In the analysis there were four groups, one for each finish, and three classes, one for each treatment. Each class was subdivided into 5 stiffness determinations. The test was carried out in two sections. First the pieces were separated into treatments. Under each treatment the sum of the squares and the degrees of freedom were determined thus:

Heart Loop—1 Readings in cms.

Tag Treatment

Calendered	*Sprinkled and Calendered*	*Calendered Over Bar*	*Friction Calendered*
22.35	23.03	24.68	24.02
22.44	23.64	23.90	23.97
22.30	22.98	23.68	23.67
21.95	23.02	24.59	23.53
22.38	23.34	24.69	23.62

$\sum_1^n x$ = 111.42 116.01 121.54 118.81 and $\sum A$ = 467.78

$(\sum_1^n x)^2$ = 12,414.4164 13,458.3201 14,771.9716 14,115.8161 and $\sum(A^2)$ = 54,760.5242

$\sum_1^n (x^2)$ = 2,483.0330 2,691.9869 2,955.3190 2,823.3555 and $\sum B$ = 10,953.6944

$(\sum A)$ = 218,818.1284 $K = 4$, $N = 20$

$\frac{(\sum A)^2}{N}$ = 10,940.9064 $n = 5$, $f_1 = K(N-1) = 16$

$\sum \frac{A^2}{n}$ = 10,952.1048 $f_2 = K - 1 = 3$

	Sum of Squares			*f*
Within finishes	$\sum B - \sum \frac{A^2}{n}$	= 10,953.6944 − 10,952.1048 =	1.5896	16
Between finishes	$\sum \frac{A^2}{n} - \frac{(\sum A)^2}{N}$	= 10,952.1048 − 10,940.9064 =	11.1984	3

*Details will be given in Part V of this series.

The sum of the squares and the degrees of freedom within finishes for the treatments was summed and the total S.S. divided by the total f to give the variance within the pieces.

	S.S.	f
Tag	1.5896	16
Heavy	.7999	16
Medium	.8790	16

$$S^2_1 = 3.2685 \div 48 = .06890$$

The sum of the squares and the degrees of freedom between the finishes for the treatments was summed and the variance calculated thus

	S.S.	f
Tag	11.1984	3
Heavy	2.7808	3
Medium	2.5146	3

$$S^2_2 = 16.4939 \div 9 = 1.8326$$

A z test showed that there is a significant difference in stiffness between the finishes since the calculated z is larger than that at the given degrees of freedom.

$$z = \frac{1}{2} \ln \frac{S_2^2}{S_1^2} = \frac{1.8326}{.06809} = \frac{1}{2} \ln 26.914 = 1.65$$

With $f_1 = 48$ and $f_2 = 9$ z is less than .8 at the .01 significance level.

Next the pieces were separated into finishes and the same procedure was carried out to show that there is a significant difference in stiffness between each treatment.

Once the variance within the pieces is determined, a t-test may be made between any two pieces to show whether they are significantly different in stiffness. Since the S_1^2 of the treatments was .06809 and the S_1^2 of the finishes was .06836,

$$S = \sqrt{.068} = .26.$$

The degrees of freedom were 48

and

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S\sqrt{\frac{n_1 n_2}{n_1 + n_2}}}$$

where $n_1 = 5$ $n_2 = 5$
$S = .26$
$\bar{x}_1$ is the mean value of the stiffer piece to be compared
$\bar{x}_2$ is the mean value of the other piece to be compared

With 48 degrees of freedom $t = 2.02$ at the .025 per cent level. Thus

$$\frac{\text{smallest significant difference}}{.26}\sqrt{\frac{25}{10}} = \frac{SSd(1.6)}{.26} = 2.02$$

smallest significant difference = .33 cms.

This test was used when the stiffness rankings of the different test methods were set up.* In addition the sensitivity of the methods could be compared by determination of the number of pieces which were shown significantly different in stiffness. A sensitive method can distinguish between small differences in stiffness while a less sensitive method shows only large differences.

*Details of application will be found in Part V of this series.

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A.A.T.C.C. OFFERS SERVICES TO THE ADVISORY COMMISSION TO THE COUNCIL OF NATIONAL DEFENSE

THE American Association of Textile Chemists and Colorists has offered its services and facilities to the Advisory Commission to the Council of National Defense. This offer has been acknowledged by Messrs. Robert Stevens, Vannevar Bush and the Commanding Officer of the Quartermasters Department, members of the National Defense Advisory Commission.

The A.A.T.C.C. is the acknowledged leader in the field of color testing and is continually alert for new developments. It is actively engaged in research, testing and standardization in order to improve colored textiles as regards their performance in use. It holds a membership in the American Standards Association and is active in the affairs of the Advisory Committee on Ultimate Consumer Goods of the A.S.A.

The importance and value of the work done by the A.A.T.C.C. can be judged by the fact that Commercial Standard CS59-39, Woven Dress Fabrics—Testing and Reporting, is based almost entirely on the test methods and standards developed by the Association. The latest revision of CS59-39 relative to the cotton wash fastness tests, was developed in cooperation with the National Association of Finishers of Textile Fabrics. The American Society for Testing Materials and the Federal Board of Specifications are others who have also adopted many of the Association test methods and standards. The very important and baffling problem of Atmospheric (Gas) Fading of Dyed Acetate Rayon is being thoroughly investigated, as are such problems as Methods for Testing for Mothproofness, Waterproofness and Evaluation of Finishes on Textile Fabrics, to mention but a few.

It is a policy of the A.A.T.C.C. to keep in contact with other technical groups and wherever deemed advisable, to cooperate with them in joint investigations.

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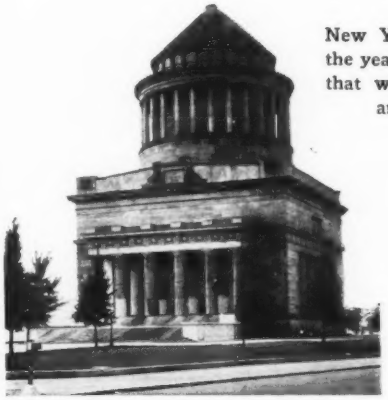
New York City is a favorite amongst sightseers the year 'round. Shown here are a number of spots that will no doubt prove popular with members and guests who attend the convention.

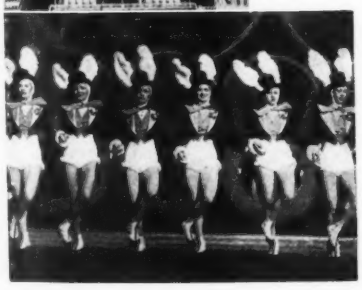


Grant's Tomb

Statue of Liberty

Empire State Building

Rockefeller Center and the Rockettes



Skyline through the Brooklyn Bridge

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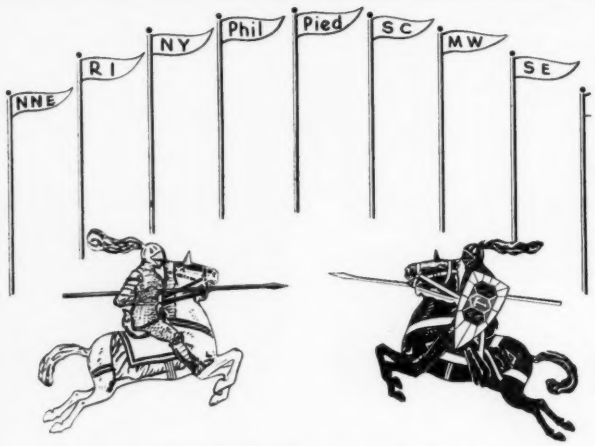
Annual Meeting and Convention

October 18, 19 and 20, 1940



INTERSECTIONAL CONTEST

AS previously announced one of the features of the technical program at the twentieth annual meeting and convention will be a contest in which each section will present a paper in competition with the other sections.

The papers which will be entered in this contest are described by the following titles:

South Central Section—"Development of Hosiery Processing in the South."

Mid-West Section—"Analysis of the Split-Bath Method of Dyeing Silk Hosiery."

New York Section — "Informative Textile Labeling."

Northern New England—"What is New in New England."

Rhode Island—"The Effect of Modern Finishing Agents on the Light Fastness of Cotton Colors."

Philadelphia — "Variables Encountered in Fadeometer Testing."

Piedmont—"Screen Printing in the South."

Southeastern — "Some Observations on the Tendering of Vat and Naphthol Dyed Army Duck on Total Exposure to Weathering."

Courtesy of New York Convention and Visitors Bureau of the Merchants Association of New York.

Trylon and Perisphere at N. Y. W. F.

"SPECIAL DAY" N. Y. WORLD'S FAIR

Luncheon at National Advisory Committee Building

THE intersectional contest is scheduled to be held on Friday afternoon, October 18th, and an award for the best paper presented will be made at a luncheon to be held at the New York World's Fair on October 20th, which has been set aside as a "Special Day" for this Association.

This luncheon will be held at the National Advisory Committee Building which offers to the members and guests attractive surroundings and excellent food.

See the Fair and honor the winner of the award!

ANNUAL MEETING AND CONVENTION

P. J. KENNEDY, General Chairman

OCTOBER 18TH AND 19TH, HOTEL COMMODORE
OCTOBER 20TH, N. Y. WORLD'S FAIR

— AUSPICES OF NEW YORK SECTION —

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RESEARCH FOR DEFENSE

THERE are two kinds of industrial mobilization. The first is surveying the industries with a view to determining in advance exactly what kind of defense work each can do, how much, and providing training through trial orders. That sort of mobilization, perhaps, is more important in the metal working trades than in any other industry. But, there is another kind of mobilization and it may prove of greater importance in the textile industries than the first.

This mobilization calls for a thorough survey of the situation by the industry itself. Especially does it require that a thorough study be made of the possibilities of any shortage of any material. For example, it might happen that, in case of war, the supply of silk would cease. Silk is something which is not produced in this country. It is not only imported but is brought here from great distances. A number of things could happen which would lessen the supply or cut it off entirely.

Should the survey indicate this might happen a research problem is promptly presented. Silk, for example, has been used for parachutes and pilots in bombing and in fighting, planes need parachutes. Therefore, it is important that some other material be found which can be used in making parachutes which are as good or better than any which have ever been made in the past.

Wool is needed for uniforms. Not sufficient wool is produced here. In case of shortage of wool what material will prove most satisfactory to take its place? Research and research alone can answer the question.

The survey needs to cover the entire field and cover it thoroughly. There is evidence that just such surveys have been going on in Germany over a period of years and the answers which research has given to the questions resulting from the surveys have made it possible for Germany to go on fighting longer than people in other nations thought possible.

In a totalitarian state such surveys are planned and directed by the government. In a true democracy they have to be planned, directed and carried out by the individual industries. The industries make the surveys not only as a matter of national defense but also as a matter of technological advance of the industry itself. The knowledge gained, even though it does not have to be used in defense of the nation, results in the building of new and profitable branches in the industry.

Each industry should discover as many ways as possible it can serve in the national defense. Modern war has demonstrated the need of providing for the evacuation of the civilians from invaded territory. Civilians impede the defending forces and may make the difference between victory and defeat. Refugees in Europe have been bad enough. What could happen in this country might be many times worse.

Here we need to bear in mind there is an average of one automobile per family. In no other nations are there as many motor vehicles per hundred of population. Few refugees would need to walk but highways would become so hopelessly clogged as to bog down both the bringing up of armed forces and the evacuation of civilians.

The need here would seem to be providing for refugee roads which could be quickly constructed. One requirement would appear to be surfacing those roads in such a manner the traffic would not raise clouds of dust which might attract enemy fire. Some suitably treated and inexpensive textile might prove to be the answer to the problem. Anyhow research would find the right answer, eventually. Narrow and unimproved roads might then be transformed into suitable emergency roads for civilian evacuation. Civilians would be safer because they were not driving on the same highways used by the armed forces and because many scattered and narrow roads were used refugees would not attract as much attention.

Such a road surface, of course, would need to be only a temporary one. It would need to be one which could be laid quickly, would serve the purpose during the emergency and could be laid immediately over a hastily prepared road bed. A thorough survey of the possibilities of making the industry just as effective as possible in defense reveals a great many problems which might never be thought of had not such a survey been made. Such a survey may also reveal peace time opportunities which might, otherwise, be overlooked.

There is a tendency to take it for granted that conditions in this country are much more like those in Europe than is actually the case. That difference in automobile

ownership between the United States and all other parts of the world is one thing which makes conditions here unlike those in Europe. The freedom of action which our industries have always enjoyed is another. It is a freedom, however, which may not always be enjoyed unless industries show effective initiative in the matter of national defense.

Some who have studied the situation for years and at first hand in Europe are of the opinion that the European dictators believe they can change our form of government and win the friendship of the dictator who takes control without making actual war on us. There are some in this nation who fear so much progress has already been made in this direction it is not going to be easy, if it proves possible, to stop it and maintain a representative government in the United States where there is the old freedom of individual and industrial initiative and action. Since a totalitarian government limits freedom it is also likely to restrict research to plans and schedules provided by the state and thus restrict progress. It is likely to lower the standard of living materially and is quite certain to take all the profit out of any private enterprise which is allowed to continue to function.

What industries do by themselves, the government does not have to do in the name of defense. What industries do not do voluntarily, the government must do or at least direct. The more powers the government takes over, the closer it approaches totalitarianism.

As we study the rise of totalitarianism in those nations now ruled by dictators we find that the industries in those nations were willing to have the government solve more and more of their problems. Some of the greatest industrialists believed that was the best course and continued to believe so until it was too late. Many of those ex-industrialists who are still living would advise American industries to increase their research greatly, to become prepared to solve defense problems of which the government might not even think until it was too late. The better each industry does its job voluntarily and without any direction or planning by the government, the more certain it is that in the name of defense it will not find itself seriously hampered by government regulation, control and planning.

Now would appear to be the time when no company engaged in any manner in the textile industry could afford not to contribute liberally to research. All those of sufficient size may well establish their own laboratories in case they have not already done so. Those of insufficient size to maintain their own laboratories can have the work done in institutions established to do the research required.

Whether or not we are invaded by an enemy the future freedom of these United States depends more upon research than upon any other one thing. It is research and research alone which can find the right solutions to the problems with which industries are faced. It is research and research alone which will put all the unemployed back to work and raise the standard of living so far above that of the peoples of Europe nobody in this country will even think of adopting those theories of government which have placed those peoples where they are.

In case of actual warfare there is nothing which means so much in national defense as the active and voluntary research of industries which cover the entire fields so well that nothing is overlooked and when any emergency arises there is an industry or a combination of industries ready to meet it and meet it effectively. It is a mistake, however, to consider defense as consisting solely of preparing to fight off attacks of hostile military forces. It is even more important that we defend our form of government against internal attack. Surely, nothing much is gained if in the act of fighting for democracy we become totalitarian ourselves and democracy vanishes from the earth.

If we can make our industries strong enough through research we have a strong defense against enemy attack because the industries of a nation play as important a part in fighting modern wars as armies do. If we can make our industries strong enough we make the country strong enough to lessen dissatisfaction to a point where it is not so easy to sell alien ideas to our people. There is good reason to believe that research and research alone will accomplish this. There is also good reason to believe that placing dependence on anything else is likely to make the last condition so much worse than the present as to defy comparison.

Water- and Washing-Resistant Finishes on Textiles—

(Concluded from page 466)

cuprous silk staple fiber to the extent of 30 per cent of the weight of the fabric. The fabric is then rolled up and left in this condition for half an hour and afterwards thoroughly rinsed and dried. It then shows a staple and full feel, and increased tearing strength and resistance to rubbing.

In a third case: (a) On a suitably adjusted squeezer an artificial viscose silk tricot is passed in such manner that, by suitable squeezing, only 50 per cent of phosphoric acid of 55° Bè. can be taken up. After approximately 15 minutes of this treatment the fabric is carefully rinsed with running water and then dried. The tricot acquires a fuller but not harder feel and possesses the desired stability, increased tearing strength and resistance to rubbing.

(b) If the tricot passes through phosphoric acid of the same strength at normal squeezing pressure while absorbing acid equal to 100 per cent-130 per cent of its weight and is then instantly rinsed in water and dried, the material will become very stiff and be greatly injured so as to be practically useless.

•TECHNICAL NOTES FROM FOREIGN SOURCES•

The Constitution of Animal Textile Fibers

M. A. Wahl—R. G. Mat. Col., 517-41, *Feb.*, 1940.—Study of the chemical constitution of textile fibers was begun in the middle of the 19th century. At that time the task of the chemist was completed when products extracted from organisms had been isolated and purified, and their elementary composition determined by analysis. Modern methods of investigation have led us to quite different conceptions of the structure of such materials as cellulose, keratin and fibroin, and data supplied by purely chemical methods have had a remarkable confirmation by x-ray examinations. Such researches, largely carried on in other countries, are of a significance which should be known, or better known, in France.

The carbon atom, chief in importance in living matter, is unique in its capacity for forming extremely complicated molecules in association with a small number of other elements, such as oxygen, hydrogen and nitrogen, and especially for the facility with which its atoms unite with one another. This association of carbon atoms gives us the suggestion of joining links, from which is derived the notion of carbon chains. Many examples of these chain molecules are encountered among both natural and synthetic products, such as the fatty acids, paraffins, certain resins and especially the textile fibers.

Animal fibers are somewhat more complicated than those of vegetable origin. Cellulose is composed of three elements, carbon, oxygen and hydrogen; silk contains nitrogen also, and wool has sulfur in addition. Raw silk is known to consist of a central portion, fibroin, which is surrounded by sericin, a material soluble in hot soap solution and composed of the same elements as fibroin. If either substance is acted on by alkaline bases or by acids it is hydrolyzed into a number of definite organic compounds.

Researches by various investigators have established certain compounds as the result of such hydrolysis. Of these the more important are glycocoll, alanine and tyrosine, the remaining constituents being also *a*-amino acids of the general formula $NH_2—CH(R)—COOH$. As together these acids amount to nearly 90 per cent of the fiber, it appears that fibroin is made up by their combination, a process which may be considered as a dehydration in which two molecules of acid unite with the loss of one molecule of water. As this reaction may occur with each function of NH_2 and COOH in additional molecules, more and more complicated compounds result. These are called polypeptides, and consist essentially of long chains in which the characteristic groups of the *a*-amino acids alternate.

As the products of hydrolysis are not simply glycocoll and alanine in molecule proportions, it is necessary to take account of the other members which unite in forming the chain. Calculations have been made of the number of molecules of each constituent so associated. Taking as a basis of calculating the least abundant member, hystidine, of which there is at least one molecule in the fibroin complex, the data of Bergman and Nieman present the following results: molecules—hystidine, 1; cystine, 4; arginine, 12; tyrosine, 162; alanine, 648; glycocoll, 1296.

It is the combination of these numerous molecules, with loss of water, which makes up the molecule of fibroin. The number of possible combinations is so great that it is not certain in just what order the chain is formed. All that may be confidently affirmed is that these polypeptide chains are composed of molecules whose length is very great in comparison to the diameter, that they are held together parallel to one another by their forces of attraction, and that their union constitutes the silk fiber.

The use of x-rays has made available a new and very interesting method of studying the finer structure of matter, one which throws additional light on problems of its atomic and molecular constitution. Examination in this way of textile fibers has revealed the existence of crystalline structure in ramie and cotton, as well as in silk and wool. It has proved possible to measure these elementary crystals and from data so secured to deduce structural formulas, in striking confirmation of conclusions reached by purely chemical methods.

Applied to the question of fibroin structure, x-ray diagrams have generally confirmed the results of chemical methods as above outlined, though it appears from such studies that fibroin consists not of one substance alone, but of two, of which but one is crystallized. The work of Brill has shown that this crystallized portion is formed exclusively through the combination of glycocoll with alanine in molecular proportions. The polypeptide chains which compose fibroin are considered to be in the most developed form, or, as it is expressed in English, in the fully extended state.

Conclusions reached in this manner permit an explanation of the mechanical properties of silk, as well as supplying reasons why it differs so distinctly from wool.

The article is to be continued. The present section reproduces five x-ray diagrams of textile fibers, furnished by the Oxford University Press.

Improvement of Substantive Dyeings in Fastness to Water and to Washing

Joseph Rière—R. G. Mat. Col., 518-93, *March*, 1940.—The problem of improving the fastness of dyeings was first taken up in 1887. Since that time treatments by metallic salts, diazotization methods, and in 1923, the introduction of synthetic products have all contributed to this end. Many patents have been granted in the field of such synthetic compounds, but these products usually act

to improve the water fastness of dyeings without contributing sensibly to their fastness against soaping, a point which up to the present time has been the chief difficulty.

Justin-Mueller has shown how fastness of dyeing is dependent upon complete absorption of dyestuff by the swollen fiber, and that dyes not so absorbed, but deposited superficially upon the fiber, are readily removed by rubbing or washing. Dyeings which for one reason or another are not satisfactory in this respect may often be improved by a supplementary treatment with certain agents, some of which are to be considered.

The need for improving color fastness is found in such instances as dyeings for discharge prints, where there is danger of ground shades bleeding into the white, in sizing, when dyed yarns are mixed with white ones, and in finishing, where bleeding of color may also occur. The trade often demands color fastness without being willing to pay the price of high class dyes; here also by proper methods of after-treatment such requirements may be met without greatly increasing the cost.

A treatment by sulfate of copper after dyeing improves fastness to light, and to some extent washing fastness also. Certain dyes of the benzo fast (copper) type may by this treatment have their washing fastness made equal to that of diazotized colors, and their light fastness rather better. A serious drawback to this method, however, is the change of shade suffered by many dyes on application of copper salts, a change for which allowance must be made in dyeing. Dyeings so treated are also more difficult to discharge in printing.

Bichromate of soda improves fastness to water and to washing. This treatment should be carried out at a temperature not below 80° C., and an addition of acetic or formic acid is necessary to insure clearness of the bath. Chrome and copper salts are also frequently used together in one bath. Other means commonly employed for improving fastness in various respects are after-treatment of dyeings by formaldehyde or by acetate of alumina, steaming of dyed fabrics and the well-known method of diazotizing and developing.

The first cation active compounds which served to improve color fastness appeared in 1923, when the introduction of the Sapamines by Ciba inaugurated the use of a new and important class of auxiliaries. These are colloidal electrolytes of high molecular weight azotized bases. Several others of this family have followed the original Sapamine CH, including the A, MS and BCH marks. More recently has appeared Sapamine KW, which affects dyed shades less markedly than does the MS, and is strongly substantive in the presence of cotton, viscose, acetate and silk. Lyofix DE, made by the same firm, is similar to the Sapamines, but is more readily soluble and gives dyeings better fastness to water. Among other such products may be mentioned Solidogene B of the I.G., Fixanol of the I.C.I. and Sandofix of Sandoz.

A large number of patents have been issued in relation to the utilization of synthetic resins as agents for treatment of dyeings. For example, French Patent No. 768,283 covers a process for increasing washing fastness of substantive dyeings by treatment with condensation products of urea-formaldehyde. Another (No. 862,631) is for a process which both fixes acid colors on cellulose and increases washing fastness of dyeings and prints by use of formaldehyde combined with the aminotriazines. An English patent (No. 498,090) describes the use of substituted amines, such as dimethylphenyl-benzamide, while French Patent No. 657,117 covers the use of complex metallic compounds, such as cupric dimethylbiguamide, for similar purposes.

From many such examples it becomes evident that synthetic chemistry has made an important contribution to the problems of improving the fastness of dyeings, and that there are now available a number of auxiliaries to facilitate such work, both from the technical and commercial standpoint.

Studies in the Naphthol AS Series

Part 3—Estimation of Members of the Naphthol AS Series

Mehta and Thosar—J. Soc. Dyers and Col., 56-160, *April,* 1940.—In view of the importance of the members of the Naphthol AS series it was desired to evolve a rapid method of estimating the quantity of naphthol either in substance or in a dye bath. Methods previously employed for this purpose presented certain difficulties and inaccuracies, as in the case of precipitating naphthol by means of hydrochloric acid, a procedure in which some of the colloidal precipitate invariably passes through the filtering medium.

A method was perfected which permitted accurate titration of the naphthol by a standard diazo salt solution, Fast Red TR Salt being selected for the purpose. The naphthol was dissolved in sodium hydroxide with the addition of alcohol and specially purified pyridine to the solution.

In determining the naphthol content of dye baths which contained an excess of caustic soda, better results were secured by neutralizing from 50 to 80 per cent of the total bath alkali with acetic acid before titrating with the diazo salt solution.

Part 4—Synthetical Experiments 1

Bhat, Forster and Venkataraman—J. Soc. Dyers and Col., 56-166, *April,* 1940.—For the purpose of a general study of the relations between chemical constitution, substantivity and fastness properties in the Naphthol AS group, a preliminary series of synthetical experiments is here recorded. As a guide to the synthetic scheme to be followed, a review was made of the structural features of numerous organic compounds that are favorable to substantivity towards cotton.

In the light of this study, the authors proceeded to synthesize 19 "naphthols," of which No. 1 in the list, di-2-hydroxy-3-naphthoylbenzidide, may serve as an example. The compounds so prepared were dyed on cotton yarn and developed with appropriate fast salts, the result-

ing dyed yarns being carefully tested for fastness to kier boiling and to rubbing.

Substantivity of each original naphthol was measured by treating cotton yarn under controlled conditions with a solution of the material, precipitating and weighing the naphthol from an aliquot part of the residual bath liquor, and calculating by difference the amount absorbed by the yarn.

Observed results are recorded in numerous tables, and curves are constructed to illustrate the substantivity determined for a number of standard naphthols as well as for the compounds prepared by the authors.

TRADE NOTES • NEW PRODUCTS

• SOURCES OF THIOUREA

Dependence on foreign sources for Thiourea, an essential chemical used in the metal, plastics, photographic, textile and chemical industries, has now been eliminated by its manufacture here on a large scale by the American Cyanamid Company, as announced recently. Heretofore, American Cyanamid has supplied the market by importations from abroad.

Thiourea is made from cyanamide, the announcement stated, and is another product in the increasing number derived by the company from this basic raw material in its program of development and diversification. Production of Thiourea in the United States, now for the first time on a commercial scale, is particularly important since demand for it is increasing rapidly as new uses are discovered. Its previous high cost has impeded full development of its applications.

It has uses in varied industries including the textile. Many textile fibers, both natural and artificial, are said to be benefited by treatment with Thiourea. Cellulose acetate rayons are softened for dyeing by immersion in a solution containing Thiourea. Further development of uses for Thiourea is expected to result from its ready availability and now lowered cost through domestic production.

Thiourea is the second compound formerly of foreign origin now made in the United States by the American Cyanamid Company. Recently announced was the production of Redsol Crystals (Potassium Sodium Ferricyanide) to replace red prussiate of potash formerly imported.

• D.C.A.T. LUNCHEON

Mr. Walter J. Quinlan, General Sales Manager of Pro-phy-lac-tic Brush Company, will be the guest speaker at the monthly luncheon meeting of the Drug, Chemical and Allied Trades Section of the New York Board of Trade on Thursday, September 19, at 12:30 P.M., at the Hotel McAlpin.

Mr. Quinlan for many years was an official of International Cellucotton Products Corporation and has had wide experience in the management of industrial problems. His speech entitled "The Value of Industrial Organization" is timely in view of the current national defense program and one which should prove both interesting and educational to all business men.

Following a procedure long observed by the D.C.A.T. Section, the luncheon will commence promptly at 12:30 P.M. and will not last beyond 2 o'clock. Early reservations are suggested and may be obtained by applying to John C. Ostrom, Secretary, 41 Park Row. The price per plate is $1.50; tables of 8 are $12.

• FISHER APPOINTED

J. Robert Fisher has been appointed manager of special products for the Millmaster Chemical Company, according to Robert J. Milano, sales manager for the company. Mr. Fisher was for eleven years affiliated with National Aniline & Chemical Company, subsidiary of the Allied Chemical & Dye Corporation. He matriculated at St. John's University and Brooklyn Polytechnical Institute.

The Millmaster Chemical Company, with research laboratories and main offices at 7 west Forty-fifth Street, New York, specializes in chemicals for the textile and allied processing industries.

• TEXTILE FOUNDATION DIRECTOR

Donald Comer of Birmingham, Alabama, who recently was appointed by President Roosevelt to serve as Director of the Textile Foundation, will fill the unexpired term of Stuart W. Cramer of Cramerton, N. C., who died July 2 this year, and whose four-year term as director expires June 11, 1941.

The Textile Foundation was organized for scientific and economic research for the benefit and development of the textile industry, its allied branches, and including that of production of raw materials. Those composing the present Board, in addition to Mr. Comer, are Franklin W. Hobbs of Boston, Mass., chairman; Frank D. Cheney, Manchester, Conn.; Harry L. Hopkins, Secretary of Commerce, and Henry A. Wallace, Secretary of Agriculture.

Mr. Comer will bring to the direction of the Foundation's objectives a broad experience and training. He attended schools in Birmingham, Ala., and Asheville, N. C., and beginning in 1898 saw service in the U. S. Army in the Philippines for four years as batallion adjutant; later being promoted to first lieutenant. In 1902 he resigned from the Army and returned home to become secretary-treasurer of B. B. Comer & Sons Company, a corporation which operated the extensive family plantation of 30,000 acres. When his father became Governor of Alabama, he went to Birmingham to operate the Avondale Mills, which, organized in 1897, operated one plant in Birmingham. This mill was so successful that in the following twenty years six other mills in the vicinity of Birmingham were built. Donald Comer became secretary and later vice-president of Avondale Mills until his father's death in 1927 when he succeeded him as president and treasurer. As several plants had been added to the group he became the active head of over 300,000 spindles and 4,800 looms. A total of seven thousand people are employed by these companies.

Donald Comer is a member of the executive committee of The Cotton-Textile Institute, Inc. and served as its southern vice-president in 1934. He is vice-president of the Southern States Industrial Council, was chairman of the Alabama Public Works Board and Alabama State director for the Rural Rehabilitation Corp. He was recently appointed by the Governor of Alabama as head of "The Decade of Progress Campaign" in Alabama, sponsored by the Southern Governors Conference. He was a member of the Cotton-Textile Code Authority under NRA and was president of the American Cotton Manufacturers Association in 1934-35.

In addition to holding executive positions with several other industrial and commercial enterprises, Mr. Comer is intimately associated with numerous public, charitable and social welfare activities.

• ADDRESS ON NYLON

Dr. G. P. Hoff, director of nylon research for E. I. duPont deNemours & Company, afforded his fellow chemists of the American Chemical Society, meeting at Detroit, a behind-the-scenes glimpse of nylon's molecular structure which endows the textile with characteristics not possessed by any other fiber, either synthetic or natural.

Dr. Hoff traced the long studies of chemical and physical phenomena leading to the discovery and development of nylon, and pictured the complex engineering facilities necessary to its production. It was the first public presentation of a scientific paper on this wholly new family of materials.

Dr. Hoff's address considered nylon only as a textile fiber, although he pointed out that an indefinite number of nylons, differing widely in their physical properties can be made.

Describing the exploration of a little-known chemical kingdom in which molecules ten-millionths of an inch long were classed as "giants," Dr. Hoff demonstrated nylon's kinship with natural proteins such

as wool and silk. Both, he explained, have a common linear structure to which nylon is closely related.

Strength, elasticity and low water absorption of nylon yarn were cited from the results of laboratory tests. Its elastic recovery was shown to be 100 per cent when stretched four per cent, as against 50 per cent for silk, 50 per cent for acetate rayon, and 30 per cent for viscose rayon.

Its dry strength is appreciably higher than that of silk or any type of rayon, while its wet strength, only slightly less, was as high as dry silk, Dr. Hoff said. In one test, water absorption of nylon was measured at 3.5 per cent, contrasted with 13 per cent for wool, 12 per cent for viscose rayon and 11 per cent for silk.

Nylon yarn and fabrics were termed "practically non-flammable" in the parlance of the Underwriters' Laboratories. As currently offered, they have the high melting point of 487 degrees F. The material was said to be resistant to mildew, molds and moths.

Nylon has been exhaustively tested for physiological activity, and proved to be completely inert. It has found use in the form of surgical sutures, he said.

Another notable quality, Dr. Hoff related, is that hot water or steam imparts a substantially permanent "set" to nylon yarn and fabrics. If a piece of yarn is straight when treated, it tends thereafter to retain that form, or, if a fabric is smooth before treatment, its tendency is to remain so. Advantage is taken of this property in making nylon stockings, in that repeated wear and washing will not alter their original shape.

Dr. Hoff also described the process of manufacturing nylon.

Nylon's principal use thus far has been in full-fashioned hosiery. Knitting, processing and dyeing operations were sketched, Dr. Hoff pointing out the numerous hurdles which had to be negotiated before satisfactory hosiery became a reality. Protective coatings to simulate the natural film found on silk, for example, had to be devised.

"During hosiery manufacture the stockings are handled frequently, and it is easy to snag and pull out individual filaments unless suitable protection is given them," he narrated. "This is a problem with natural silk, although it has a protective coating called 'sericin' which binds the filaments together. The sericin softens during the wetting-out of the yarn and hardens again on evaporation of the moisture to give a firm fabric with all the stitch loops held in place. It was necessary to find a material called a size which would do for nylon what sericin does for natural silk, to protect the filaments during the various handling operations, and which could easily be removed after it had served its purpose."

Nylon in the form of yarn, or in other forms, is "difficultly soluble" in most reagents, Dr. Hoff said. Phenols and formic acid are active solvents, but all the common dry cleaning solvents are without effect. While the resistance of nylon to mineral acids is "not remarkable," it is quite resistant to alkalies even in fairly concentrated solutions, and even at high temperatures, he showed.

● GULICK APPOINTED

Appointment of C. P. Gulick, president and chairman of the board of the National Oil Products Co., Harrison, N. J., to the Resolutions Committee and the Sponsoring Committee of the National Association of Manufacturers has been announced by H. W. Prentis, president of N.A.M.

In the Resolutions Committee post, Mr. Gulick will be called upon to assist in the preparation of the 1940 Platform of Industry. The Sponsoring Committee is designed to rally support for private enterprise.

Mr. Gulick is also a member of the Development Committee, Industrial Practices Committee and Public Relations Committee of the N.A.M.

● APPOINTED CHAIRMAN

James C. Hayes, assistant manager of National Aniline & Chemical Company, 150 Causeway Street, Boston, has accepted the chairmanship of the chemicals division in the Greater Boston Annual Maintenance Appeal of the Salvation Army. He is forming an active committee to put the Chemical Group over-the-top soon after the campaign opens in the early days of October.

Mr. Hayes is a graduate of Northeastern University of Boston, and has for years been an active member of the Boston Athletic Association and busy in the doings of the Unicorn Club. He was recently elected president of the Dry Salters Club, the social organization of the chemical industry in Massachusetts. He is a member of the American Association of Textile Chemists and Colorists.

● TEXTILE UNIT ESTABLISHED

With a view to studying and solving rayon textile manufacturing problems wherever they may arise, the American Viscose Corporation has established an experimental Textile Unit at Marcus Hook, Pa. This new department of the company is now in operation, in connection with the company's Sales Development Department and laboratories.

The purposes of the unit are: Textile research to develop new technique and methods as well as machinery; testing the company's products in the various textile processes; checking practice and procedure in textile mills; and manufacturing samples for the fabric development department in New York.

As the Sales Development Department under the management of E. S. Kennedy, is made up of technical men, the unit logically comes under the supervision of that department. An important phase of administrative policy is the close working relationship between the Textile Unit, of which Rene Bouvet is in charge, and the Company's Textile Research and Standards Laboratory, of which Dr. F. Bonnet is manager. All major laboratory work for the unit is handled by Dr. Bonnet's department.

Facilities in the dyeing and finishing department provide for the dyeing and finishing of rayon in its various forms from fiber to fabric. They include equipment for dyeing and finishing raw stock, skeins, packages, hosiery, and also for fabric dyeing and finishing on various types of machinery.

● BANKS APPOINTED

Reginald M. Banks has been appointed Assistant to the President of the American Cyanamid Co. to promote the coordination of research and sales activities, according to an announcement made recently by the company.

Mr. Banks came to Cyanamid in 1928 from Nitrate Agencies Co., a subsidiary of W. R. Grace & Co. He has recently been manager of the Organic Chemical Sales Department of American Cyanamid & Chemical Co.

Walter T. Mac Adam has been appointed to fill the post left vacant by Mr. Banks' promotion.

● duPONT RELEASES

E. I. duPont deNemours & Co., Inc., Wilmington, Delaware, have announced release of the following new products:

Pontachrome Fast Red 2 R L—a new fast-to-light chrome dyestuff announced by the dyestuff division. It can be applied to slubbing, loose wool, yarn and piecegoods by either the after-chrome or chromate method. It is said to possess very good fastness to light. It is stated that the light fastness and the intermediate red shade make the dye suitable for shading in the dyeing of upholstery fabrics, men's wear worsteds for suitings and overcoatings. The new dyestuff fades evenly without change of hue, dyes levelly, exhausts and penetrates well and is readily soluble, according to the company's announcements. It can be applied in open kettles and other types of mechanical apparatus ordinarily used for chrome colors.

Two Normal Primary Alcohols — Normal octanol and normal deconol, announced by the Fine Chemicals Division. This is the first time these alcohols, which have been extensively used in the laboratory, have been available in commercial quantities. They are good anti-foaming agents, the company says, and provide a

means of introducing octyl and decyl groups for chemical manufacture. They may be used as mixed solvents for the extraction of fats and oils.

Both alcohols have very low solubility in water, but abate foam effectively within the solubility limits, 0.01%-0.05%, according to the company. Normal decanol has a bland odor.

Specifications of the two alcohols are as follows: normal octanol, specific gravity 25/25° C., 0.8225-0.8250; hydroxyl number, 430 plus or minus 15; iodine number less than 1; distillation range, A.S.T.M. method, 90% between 193-196° C.; appearance, water white. Normal decanol, specific gravity 25/25° C., 0.8300-0.8380; hydroxyl number, 360 plus or minus 15; iodine number less than 1; distillation range, A.S.T.M. method, 90% between 228-233° C.; appearance, water white.

• DYESTUFFS

Dyestuffs, published quarterly by National Aniline & Chemical Co., Inc., 40 Rector Street, New York City, contains in its July, 1940, issue articles described by the following titles: "The 'Sighting' of Wool Yarns" by M. L. Scrinding; "Dyeing Cotton, Linen and Wool Goods with Indigo"; "Leather—A Variable Material"; "1940 Fall Colors for Hat Bodies on Fur Felt"; "New Hosiery Shades for Fall 1940"; "The Dyehouse" (concluded from March issue); "Bacteria in Soaking Bath Found to Affect Tinting" by A. J. Kellner. Copies of *Dyestuffs* are available upon request.

• TEXTILE PREPAREDNESS SYMPOSIUM

The American Association of Textile Technologists announces that arrangements are being completed for a symposium on "Textile Preparedness for National Defense." This session will be held at the Hotel Commodore on October 1, 1940 at 4 P.M. and will be followed by dinner and speeches.

The partial program to date includes Arthur Besse, President of the National Association of Wool Manufacturers, and until recently with the National Defense Advisory Committee. Mr. Besse's topic is to be announced later. Lieut. Col. George F. Spann, Q.M.C., Procurement Planning Officer of the War Department's New York General Depot, will speak on "How Textile Mills Can Fulfill Government Contracts Most Efficiently"; Lieut. Lawrence Smith, S. C., U.S.N., of the Brooklyn Naval Clothing Depot will discuss "Textiles Used in Navy Uniforms," and Captain A. Dennis of the War Department's Philadelphia Quartermaster Depot will discuss "Textiles Used in Army Uniforms."

In view of the far-reaching effects on the textile industry of the program of industrial preparedness and because of the importance of the speakers, the American Association of Textile Technologists invites all manufacturers of textiles to apply at an early date for reservations for the meeting and dinner by writing to the Association's secretary, Miss Bernice S. Bronner, 959 Eighth Avenue, Room 604, New York.

• COMPLETE NYLON COSTUME

A complete costume of garments made with nylon fabrics—lace evening gown, stockings, satin slippers, and even undergarments—will be shown in the finale of the stage show at the Du Pont Exhibit, New York World's Fair, which began August 29th. Clad in nylon from head to toe, the first of all women to wear it this way, is the description given to "Miss Chemistry of the Future," who models this costume of tomorrow.

Neither nylon lace nor some of the other nylon products shown at the Fair are as yet available commercially.

• SILK PARADE

Requests for the seventh annual Silk Parade poster to be released shortly, are reported pouring in to International Silk Guild offices from fabric manufacturers, wholesale houses, department stores and specialty shops throughout the country that are planning to cooperate with this quality promotion, which begins the week of September 23rd. Since there are approximately 25 departments in the average store featuring more than 60 items of silk merchandise, many stores are planning to emphasize the Silk Parade's store-wide scope by identifying every department handling silk items with one or more Silk Parade posters.

The 1940 poster tells the story of the glamour and beauty of silk, dramatizes the importance of silk in news and in fashion. It represents a portrait of silk framed by a montage of news and fashion pictures of silk merchandise, reflecting the current mode for paintings as a focal point in retail window displays.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson Street, New York City, has released circulars describing the following products:

Benzo Green G A Conc.—a yellowish direct green said to be of good dischargeability. It is stated that it is well adapted to the dyeing of cotton, rayon and pure or weighted silk and on union materials of cotton and wool, or rayon and wool, fairly uniform shades are produced. Circular G-186.

Indanthrene Golden Orange 3 G A Extra Paste Fine—for printing. It produces on cotton or on rayon, prints said to be of excellent fastness to washing, to chlorine and to light. While of general interest for printing, it is a particularly useful product for the printing of draperies. It is a non-drying paste and fixes readily. The preparation of the print paste does not require any special handling. The dyestuff is merely stirred into a suitable vat color thickening.—Circular G-192.

Burmol Extra—a bleaching and cleansing agent the outstanding property of which is said to be its ability to reduce and dissolve iron compounds in an alkaline or neutral solution. It is a white powder of good solubility; its aqueous solutions react weakly alkaline and are stable for some time. It is, however, advisable to dissolve the product just before use. It is intended for application as follows: for removing spots, especially rust, from white goods or for treating spotted or yellowed white goods during the washing process or afterwards; for removing iron impurities in general, or for counteracting the yellowish tint of undyed textiles, in particular for bleached textiles which are discolored by the influence of ferruginous water; for stripping dyestuffs which are difficult to remove, as for instance, chrome dyestuffs; in special cases for removing iron impurities from natural products. Circular G-196.

• CHEMICAL DEVELOPMENTS ABROAD

James W. Young, Director of the Bureau of Foreign and Domestic Commerce, announced recently publication of "Chemical Developments Abroad, 1939," a 183-page booklet reviewing the effect of munitions and preparedness upon chemical production, consumption and foreign trade in the past year.

Prepared by C. C. Concannon, Chief, and A. H. Swift, of the Chemical Division. This review, the seventh annual number in a series covering chemical developments throughout the world, discusses conditions affecting the chemical industry both prior to the actual outbreak of war in September, 1939, and the effects of the war so far as ascertainable in 52 countries located in all world areas.

Of the countries treated, over half were involved in hostilities, and although much of the news was censored the data contained in the review are believed accurate. Sources were reports submitted by the foreign offices of the Department of State and official data and statistics supplied to the Department of Commerce by the various foreign countries.

Although no single new commodity actually was developed in 1939, several new uses for old commodities and new processes were evolved under the pressure of war conditions. England marketed a blackout paint; the German army adopted a bromine derivative for an antiseptic agent, and employed many substitutes using German materials entirely.

The review contains additional data regarding the progress attained during 1939

on raw-material experimentation and lists chemical plant construction and expansions for the year.

"Chemical Developments Abroad, 1939," also known as Trade Promotion Series No. 211, is for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 20 cents per copy.

• NEW MATHIESON PLANT

A new plant, costing approximately $400,000, is being built by Mathieson Alkali Works, Inc., at Niagara Falls, to produce sodium chlorite, the newly developed chemical that promises to have wide use in the wood pulp, textile, and other industries.

Sodium chlorite, though long known as a laboratory chemical, was discovered by the Mathieson research organization to have special properties that make it valuable for use in many important industrial processes.

It is claimed that it will bleach kraft wood pulp as white as book paper pulp without weakening the fibers, which cannot be done with the use of hypochlorite, now universally employed for bleaching this product. This makes possible the production of a paper that is much stronger and whiter than anything that could heretofore be produced.

In the textile field, it is said to permit the scouring and bleaching of cotton and rayon in a single operation, instead of in two, and also to make possible the simplification of other textile finishing operations.

Other industries, such as flour milling, starch manufacturing, and straw hat making, will also be benefitted by the use of the new product.

The new chlorite plant, which is expected to be completed early in 1941, is located near the present Mathieson Niagara Falls plant on Buffalo Avenue. The design of the plant gave rise to many difficult engineering and operating problems, and before some of them could be solved, a small experimental plant had to be built and operated for two years. High-grade alloys are largely used in constructing the necessary equipment.

• WAGE-HOUR ENFORCEMENT

Inspection of the thousand or more establishments in the woolen textile industry in a concerted nation-wide five-industry drive for enforcement of the 36 cents an hour minimum wage order under the Fair Labor Standards Act was to be under way early in September, according to announcement by Colonel Philip B. Fleming, Administrator of the Wage and Hour Division.

Other industries included in the inspection program are furniture, leather goods and luggage, hosiery and boots and shoes. More than 250 inspectors will be assigned, sufficient to permit the inspection of every one of the 5,610 establishments in these industries by October 1. About 50 will devote their attention exclusively to the woolen industry.

The inspections among the woolen establishments will center in the New England States, New York State and in Pennsylvania, where more than three-fourths of the industry is located.

• FOXBORO REPRESENTATIVES

C. E. Sullivan, vice president and sales manager of the Foxboro Company, Foxboro, Mass., announces the appointment of Bumstead-Woolford as exclusive sales representatives for the Oregon and Washington territory. The arrangement became effective as of August 1. The Foxboro Company manufactures instruments of measurement and control, for industrial processes, and its customers in the Pacific Northwest include the great lumber and paper mills located there, as well as food packers, power plants, and companies in every other industrial field.

• CELANESE PATENTS

The Celanese Corporation of America has been granted two additional United States Letters Patents relating to improved technique of operations in the cellulose acetate and regenerated cellulose fields.

The first patent, No. 2,211,861, issued on an application of H. Platt and R. R. Sitzler, relates to the finishing of fabrics or yarns containing organic derivatives of cellulose, such as cellulose acetate and particularly colored materials, in order to improve their fastness to light and acid fading.

Under the invention dyed cellulose acetate materials, whether dry or damp, are subjected to the action of dry heat at a temperature of at least 100 degrees Centigrade, and preferably 150 to 180 degrees, Centigrade, for a sufficient period of time to increase the fastness of the dyeing.

This new process is said to be of particular usefulness in connection with cellulose acetate materials dyed with amino anthraquinone dyes. Preferably, the treatment is given to the material immediately after the last wet finishing process; such as, for example, a dyeing and scouring operation.

The second patent, No. 2,211,872, issued on an application of A. J. Wesson and G. H. Ellis, covers the treatment of filaments, yarns and the like of cellulose or regenerated cellulose, and particularly such filaments and yarns having a high tenacity.

By this invention filaments or yarns of regenerated cellulose of high tenacity, in admixture with filaments or yarns of an organic ester of cellulose such as cellulose acetate, are treated with aqueous solutions of caustic soda containing buffering agents. Sugars are preferred as such agents, but others such as polyhydric alcohols, amino acids and weak inorganic acids may be used.

Presence of the buffering agent prevents any deleterious action on the regenerated cellulose filaments and yarns and also prevents any substantial saponification of the cellulose ester.

This treatment is said to bring about an increased affinity of the regenerated cellulose filaments, etc., for cotton dyes and an improved flexibility and extensibility of the filaments and yarns.

• JOINS ARTISTIC FOUNDATIONS

Frederick A. Alter, for several years chief dyer for the Kendall Company of Boston, Mass., at their finishing division at Slatersville, R. I., has been appointed superintendent of dyeing and finishing divisions of Artistic Foundations, Inc., of New York, N. Y., at their Kulpmont plant in Pennsylvania. Mr. Alter has for years been an active member of the AATCC in Providence, R. I., and is now making his home in Mt. Carmel, Penn.

William Sheriff, for several years successfully affiliated with the dyeing and finishing industry at Hamburg, Penn., has been promoted to the position of foreman of the dyeing and finishing division at the Kulpmont, Penn., plant of Artistic Foundations, Inc., recently. Mr. Sheriff is an active member of the AATCC, in the Philadelphia section.

• CHEMICAL EXPORTS

United States exports of chemicals and related products were valued at $24,685,500 during July of this year compared with $13,360,800 during July, 1939, an increase of 84 per cent, according to C. C. Concannon, chief, Chemical Division, Department of Commerce.

Foreign demand for almost every class of chemicals continued to advance sharply in July, particularly for explosives, coal-tar products, industrial chemicals and medicinal preparations.

Demand for coal-tar products continued heavy in July, particularly for dyes and related products, with the total value of shipments reaching $2,587,883 against $663,161 in July of last year. Exports of dyes, colors, stains and lakes during these periods increased in value from $345,089 in July, 1939 to $1,589,245 during July of the current year.

• NEW SWING JOINT

For handling steam pressures up to 100 lbs., a simple and effective swing joint has been developed. The sealing unit is a specially shaped and compounded rubber gasket. This gasket contains a percentage of very finely divided metallic lead, milled directly into the rubber. Because the lead acts as a lubricant, the joint turns freely under pressure. The gasket is expanded slightly by the heat, which helps to maintain a perfect seal.

By equipping steam lines with a swing joint of this type a flexible connection is maintained by the pipe to actuate movement of mechanism.

The joint is made of heavy bronze, weighs approximately 4½ lbs., and is available only in the ¾" straight style. The product is made by Patterson-Ballagh Corporation, manufacturers of rubber specialties and equipment requiring the use of rubber.

Further information can be obtained by writing that company at 1900 East 65th Street, Los Angeles, Calif.

• SAFE HANDLING OF CHLORINE

A new revised chlorine safety chart has recently been prepared by the Mathieson Alkali Works (Inc.) who originally initiated the idea of such a chart. The chart is neatly and attractively set up in green and black with cuts of the valves used on the three standard types of chlorine containers. The detailed schematic representation and careful labeling of the valve types greatly enhance the value of the chart as a a whole.

The essential requirements in the safe handling of liquid chlorine are outlined in the form of 24 suggestions. This subject matter is subdivided under the headings: handling containers, gas masks, chlorine leaks, and first aid measures. The material, while not intended to cover every possible contingency, is considerably more complete than anything of a similar nature available, incorporating as it does new suggestions on the storage of containers, the handling of containers and valves, the stopping of leaks, and the effective use of gas masks.

Copies may be obtained by interested parties addressing the Mathieson Alkali Works, Inc., 60 East 42nd Street, New York, N. Y., on their business letterheads.

• MODERNIZE DYE-HOUSE

The A. D. Ellis Mills of Munson, Mass., makers of fine specialty fabrics such as billiard cloth, tennis ball coverings, casket linings, etc., have recently completely modernized their dye-house with an installation of Rodney Hunt "Tru-Shade" stainless steel dyeing machines. These have replaced older type wood dye kettles, and are said to provide greater uniformity of quality and speed of production. One of the most progressive woolen mills in the East, the Ellis Mills can now point with pride to one of the most modern dye-houses in the country.

• COLUMBIA EVENING COURSES

University Extension of Columbia University announces the following schedule of courses and opening dates for the Winter Session of 1940-1941:

Textile eZ3—Spinning and Weaving of Rayons and Spun Rayons—Thursdays, 7:30 to 9:20 p.m. Mr. H. R. Mauersberger. Begins September 26th.

Textiles eZ13—Textile Chemistry—Lectures and Laboratory. Fridays, 7:30 to 9:20 p.m. Mr. A. K. Gyzander. Begins September 27th.

Textiles eZ1—Spinning and Weaving of Cotton—Mondays, 7:30 to 9:20 p.m. Mr. H. R. Mauersberger. Begins September 30th.

Textiles eZ9—Woolen and Worsted Manufacture—Mondays, 7:30 to 9:20 p.m. Mr. W. von Bergen. Begins September 30th.

Textile eZ5—Woven and Printed Fabric Design—Tuesdays, 7:30 to 9:20 p.m. Mr. William H. Arlt. Begins October 1st.

Marketing e15—Merchandising and Marketing of Textiles—Tuesdays, 7:40 to 9:30 p.m. Mr. Sidney S. Anhalt. Begins October 1st. (New course).

Textiles eZ11—Identification, Analysis and Testing of Textiles—Wednesdays, 7:30 to 9:30 p.m. Mr. G. R. Turner. Begins October 2nd.

These courses extend for a period of 15 weeks and are open to all qualified students without examination. Registration begins Friday, September 20th. Instructors may be consulted during the registration period from 6 to 9 p.m. in Room 301, School of Business Building, northeast corner of 116th Street and Broadway, New York. All inquiries should be addressed to the Director of University Extension, Columbia University.

• VARIDRIVE-SYNCROGEAR UNITS

In order to provide more compact and smaller units, U. S. Electrical Motors, Inc., 200 E. Slauson Avenue, Los Angeles, Cal., and 80—34th Street, Brooklyn, N. Y., has added the types VEV-GD and VEV-GT to its Varidrive line. These motors are of the Varidrive speed design with the double reduction and triple reduction gears for low speed drives.

This new construction, it is claimed, does not require a sub base to mount the Varidrive and Syncrogear as a unit and is consequently much lighter and more compact.

Further modification of the old design allows mounting of the Varidrive case at any angle with respect to the gear case. If the unit is to be mounted where head room is low, the Varidrive case may be laid over on its side or at any convenient angle.

The Pyramidal gear pedestal is characteristic of the rugged design of U. S. Syncrogear Motors providing both a rigid mounting for the Varidrive case and a sturdy Syncrogear Motor capable of withstanding the heavy torsional stress resulting from heavy loads at low speeds.

The tooth surfaces of gears in all U. S. Syncrogear Motors are hardened to 55/65 Scleroscope providing a high standard of surface hardness which means much longer life to the geared unit. It is said the core or inner body of the pinions is extremely tough and of proper ductility to assure maximum resistance to fatigue caused from recurring shock stress. Syncrogear bulletins may be obtained from U. S. Electrical Motors, Inc., Dept. 5, 80—34th Street, Brooklyn, N. Y.

• BLACK SULPHUR DYE FEATURED BY CALCO

Calcogene Black RBCF is the name of a red tone black dye featured by the Calco Chemical Division, American Cyanamid Company, in another of its series of color announcements. It is claimed this dye, because of its properties, will appeal to the trade having use for a sulphur black of exceptional fastness to light and wet treatments.

According to Calco's folder, the shade produced by Calcogene Black RBCF has bright and bloomy overcast. It is a "copper free" color and is, therefore, suitable for dyeing material which is to be rubberized.

For blends of wool and rayon, it is recommended that Calgogene Black RBCF be used for the rayon staple material. The ability of this color to withstand wet finishing operations such as fulling makes it an excellent dye for this purpose. Dyeing methods and tables of properties for Calcogene Black RBCF are given in Calco's folder.

Like other Calco announcements, this particular bulletin is standard file size. The color and type of dye are printed clearly on a convenient reference tab attached to the folder. Copies can be obtained from Calco Chemical Company, Inc., Bound Brook, N. J.

• RODNEY HUNT WATER WHEEL CATALOG

The Rodney Hunt Machine Company of Orange, Mass., who have been making water turbines for over 75 years, have just published a new catalog, No. WW40, which they state is the most complete catalog of water power equipment ever published. Its 124 pages cover information on how to modernize water wheels for greater efficiency of operation, shows several pages of typical installations in photographs and diagrams, lists a complete line of water control equipment, and includes some 30 pages of hydraulic engineering data. The catalog features recent patented improvements in Water Wheel design and cites numerous examples of how the modernization of water power equipment has paid 30 per cent to 50 per cent dividends on the investment.

• OPEN FORUM •

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

Question

52—We are dyeing and finishing gabardines containing 15 per cent wool and 85 per cent rayon in the warp, while the filling is 100 per cent cotton and have considerable trouble with streaky shades warp wise on the face when dyed in tan shades.

It is possible that some of the readers of the OPEN FORUM may have suggestions regarding this difficulty.—**T. M. A.**

Answer—Considerably more data should be given to get to the bottom of the trouble. If the streaks appear before finishing you can be sure that the trouble is with the scour or dyeing or both. In saying that I am assuming the streaks are not rope marks but only a slight cross dyeing between the wool and rayon.

The scour before dyeing should be thorough and yet mild enough to keep from harming the wool; if not, the difference will cause the wool and rayon to be cross-dyed. Most likely you will find the trouble is with your selection of dyes. It is a tedious job for the laboratory to "weed out" your dyes but it is necessary and should be done.

Not knowing what type of finish your fabric gets, I would hesitate to make a statement concerning that end of the problem.—**J.W.H.**

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Chemist, June, 1940, B.S. with excellent record who has studied dyestuffs and dyeing as a hobby wishes to enter any branch of the industry. Write Box No. 258, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

Colorist wanted as assistant in laboratory of dyestuff manufacturer. Must be textile school graduate with at least two years' experience. Write in full details. Box No. 259, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Organic Chemist. Control or research B.S. Graduate work in Organic and Biochemistry. Work in Spectrophotometry and colorimetry. Free to travel. References. Write Box No. 256, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Chemist, rayon processing man, sixteen years experience with leading organizations. Can supervise the dyeing and finishing of rayon, acetate, cotton fabrics, the chemical control, economy, research, improvements. Write Box No. 255, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

Use Reporter Classified Advertisements for Results!